EPSON

EPSON RC+ Option

Fieldbus I/O

Rev.6

EM07ZS1647F

EPSON RC+ Option Fieldbus I/O Rev.6

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FOREWORD

This manual contains important information necessary to use the EPSON RC+ option Fieldbus I/O properly and safely. This manual is intended for personnel who perform any operations that use the pendant, such as teaching robot points.

Please thoroughly read this and other related manuals before and while using the equipment.

WARRANTY

The robot and its optional parts are shipped to our customers only after being subjected to the strictest quality controls, tests, and inspections to certify its compliance with our high performance standards.

Product malfunctions resulting from normal handling or operation will be repaired free of charge during the normal warranty period. (Please ask your Regional Sales Office for warranty period information.)

However, customers will be charged for repairs in the following cases (even if they occur during the warranty period):

1. Damage or malfunction caused by improper use which is not described in the manual, or careless use.
2. Malfunctions caused by customers' unauthorized disassembly.
3. Damage due to improper adjustments or unauthorized repair attempts.
4. Damage caused by natural disasters such as earthquake, flood, etc.

Warnings, Cautions, Usage:

1. If the robot or associated equipment is used outside of the usage conditions and product specifications described in the manuals, this warranty is void.
2. If you do not follow the WARNINGS and CAUTIONS in this manual, we cannot be responsible for any malfunction or accident, even if the result is injury or death.
3. We cannot foresee all possible dangers and consequences. Therefore, this manual cannot warn the user of all possible hazards.

TRADEMARKS

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TRADEMARK NOTATION IN THIS MANUAL

Microsoft® Windows® 2000 Operating system
Microsoft® Windows® XP Operating system
Throughout this manual, Windows 2000, and Windows XP refer to above respective operating systems. In some cases, Windows refers generically to Windows 2000, and Windows XP.

NOTICE

No part of this manual may be copied or reproduced without authorization.
The contents of this manual are subject to change without notice.
Please notify us if you should find any errors in this manual or if you have any comments regarding its contents.

INQUIRIES

Contact the following service center for robot repairs, inspections or adjustments.
If service center information is not indicated below, please contact the supplier office for your region.
Please prepare the following items before you contact us.

- Your controller model and its serial number
- Your manipulator model and its serial number
- Software and its version in your robot system
- A description of the problem

SERVICE CENTER

MANUFACTURER & SUPPLIER

Japan & Others

SEIKO EPSON CORPORATION
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1010 Fujimi, Fujimi-machi,
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TEL : +49-(0)-2159-538-1391
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Before Reading This Manual

This section describes what you should know before reading this manual.

Safety Precautions

Installation and transportation of robots and robotic equipment shall be performed by qualified personnel and should conform to all national and local codes.

Please carefully read this manual and other related manuals before installing the robot system or before connecting cables.

Keep this manual handy for easy access at all times. Please read the Safety chapter in User's Guide to understand safety requirements before installing the robot system.

Conventions

Important safety considerations are indicated throughout the manual by the following symbols. Be sure to read the descriptions shown with each symbol.

 WARNING	This sign indicates that a danger of serious injury or death will exist if those instructions are not followed.
 WARNING	This sign indicates that a danger of possible harm to people caused by electric shock will exist if those instructions are not followed.
 CAUTION	This sign indicates that ignoring these instruction may cause harm to people or physical damage to equipment and facilities.

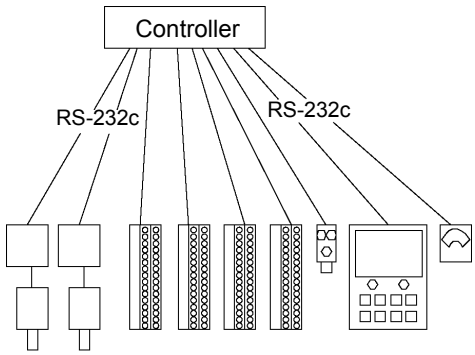
1. Introduction

1.1 Overview of Fieldbus I/O

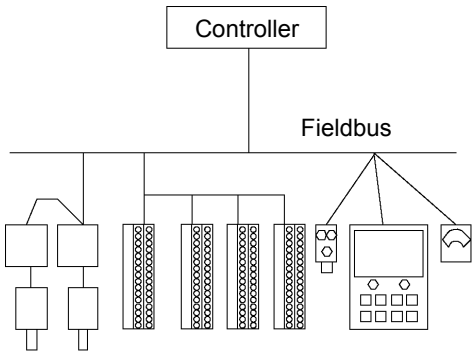
The Fieldbus I/O option is an integrated I/O system that supports DeviceNet, PROFIBUS DP, and EtherNet/IP fieldbuses.

A fieldbus is a standard of signal communications between field devices operating in a factory (sensor, actuator, robot controller, etc.) and controller (PLC or robot controller) using serial communications. Compared to signal communications using analog signals, a fieldbus has the following features:

- Access to signals from multiple devices and multiple data from each device using one cable.
- Precise signal transmission since there is no need for A/D conversion and D/A conversion.
- Less wiring costs, including signal relay board costs and installation area due to several dozen (or a hundred) devices connected on one fieldbus.
- More flexible modification and expansion of a system because multiple devices are simply added to one fieldbus without additional wiring.
- Slave devices can transmit self-diagnostics information.



Sample Parallel Connection



Sample Fieldbus Connection

For each fieldbus on the RCxxx controller, there is at least one board installed. You can use more that one fieldbus type on the same controller. You can also use multiple boards for the same fieldbus type. The EPSON RC+ software key Fieldbus I/O Option must be enabled to use this option.

NOTE

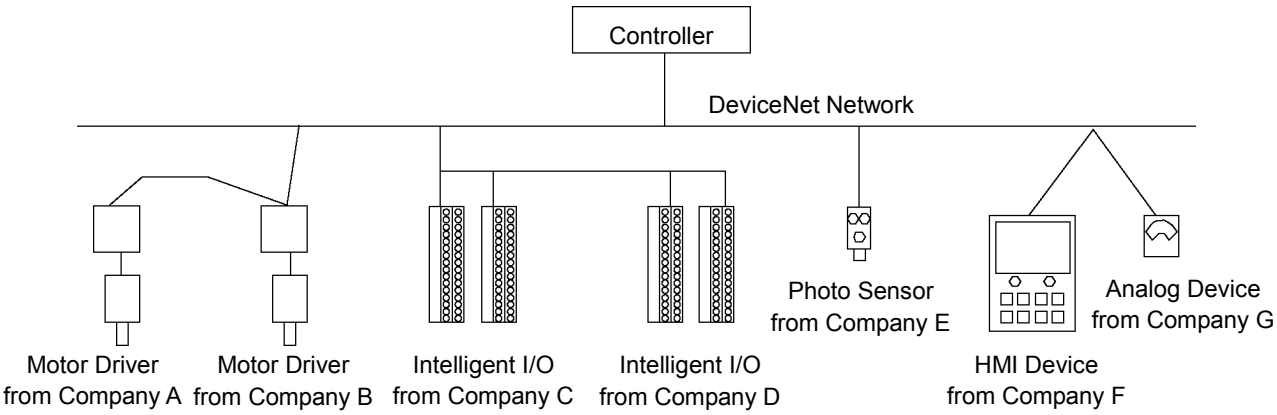
Response times for Fieldbus I/O can vary and depend on several factors, including baud rate, scan rate, number and types of devices, number of SPEL+ tasks, etc. When the fastest and most consistent response times are required, please use EPSON standard digital I/O, which incorporates interrupt driven inputs and outputs.

1.2 DeviceNet

Overview of DeviceNet

DeviceNet is a fieldbus network that provides easy interconnection between control devices (PLC, PC, sensor, actuator, etc.).

DeviceNet was developed by Allen-Bradley as an open communication standard to connect various field devices (sensor, actuator, robot controller, etc.). Because of the open communication standard, DeviceNet users can easily construct a multi-vendor system with various devices developed around the world.



Features of DeviceNet

Reduced Wiring

Compared with parallel wiring, DeviceNet employs a dedicated 5-wire cable (signal wires and power wires) which substantially reduces the number of necessary wires, wiring time and cost.

Detachable communication connectors provide you with simple wiring between nodes and easy network separation or reconstruction.

Specified environment-resistance cables allow you to construct an environment-resistant system at low cost.

Open Standard (Multi-vendor)

Due to an open communication standard, various devices from many manufacturers are available. Standardized communication connectors provide you with easy network construction.

The maintenance spare parts stored on site (factory, etc.) can be reduced because different manufacturers' devices are used in case of a breakdown. Similar products are available around the world due to a global standard DeviceNet.

Large Numbers of Inputs/Outputs

For EPSON RC+ standard I/O and expansion I/O, the number of inputs/outputs is limited to 512 inputs and 512 outputs. When configuring a device to be a master of fieldbus I/O, you can control more than 16,000 total inputs and outputs.
For a slave device, 2,040 inputs (255 bytes) and 2,040 outputs (255 bytes) are available.

Different Connection Types

There are two messaging connections: I/O messaging connection and explicit messaging connection. The I/O messaging connection includes polling, strobe, cyclic, and change of state. I/O messaging connections are explained below:

Polling: First, a master device sends output data to a slave device and then the slave device responds. Data is normally exchanged in every communication cycle. The communication frequency can be changed by setting. This connection type is the most often used.

Strobe: First, a master device requests slave devices to send data with multicast messages, and then, each slave device responds separately.
Data from many sensors on the system can be effectively gathered. When the master does not receive responses from all requested slave devices, a timeout error occurs.

Change Of State:
A device sends data whenever it changes. Signals for device diagnosis are sent regularly in the background. This connection type is useful for remedying DeviceNet communication traffic.

Cyclic: A slave device transfers data regularly according to its internal timer. This connection type is typically used for communicating with a temperature controller. The data transfer frequency is defined by master configuration.

NOTE

For Change of State and Cyclic, you can disable the ACK that is for verifying that communication is completed. Never disable ACK, since communication errors cannot be detected.

Functions of Master

The Master device gathers and controls all nodes on one network.

A DeviceNet master can control up to 64 nodes (max. 2 kbytes) on one network.

A PLC is typically configured as a master and controls all nodes in factory automation system, but EPSON RC+ is also capable of being a master.

DeviceNet network configuration is specified by configuration management software. This software is normally provided by a master device manufacturer. The configuration management software determines parameters for each slave device via an Electronic Data Sheet (EDS).

Available connection types are Polling, Strove, Cyclic, Change Of State, and explicit messaging.

Available baud rates are 125 kbps, 250 kbps, and 500 kbps.

Functions of Slave

A slave can exchange data with a master device.

The configuration management software identifies parameters of each slave device via Electronic Data Sheet (EDS) where the parameters are registered.

Available connection types are Polling, Strobe, Cyclic, and Change of State.

Available baud rates are 125 kbps, 250 kbps, and 500 kbps.

General Specifications

Electrical Specifications

Item	Specification
Supply Voltage	5 V DC (supplied from a controller)
Power Consumption	7 W
Ambient Temperature	5-40 deg C
Relative Humidity	20-80%

DeviceNet Communication Specifications

Item	Specification			
Supported Connection	- I/O messaging connection (Polling, Strove, Cyclic, Change of State) - Explicit messaging connection All connections are conformed to DeviceNet communication protocol.			
Baud Rates	125 kbps, 250 kbps, 500 kbps			
Transfer Distance	Baud Rates	Max. Network Length	Drop Length	Total Drop Line Length
	500 kbps	100 m	6 m or under	39 m or under
	250 kbps	250 m *	6 m or under	78 m or under
	125 kbps	500 m *	6 m or under	156 m or under
Maximum Nodes	64 (including master unit)			
Data Length / Frame	8 byte (The data can be divided and transferred.)			
Bus Access	CSMA/NBA			
Error Detection	CRC error / Duplicate node address check			
Cable	5-wire cable dedicated to DeviceNet (2 wires for signal, 2 wires for power supply, 1 shield wire)			
Communications Power Supply Voltage	24 V DC (supplied from a connector)			

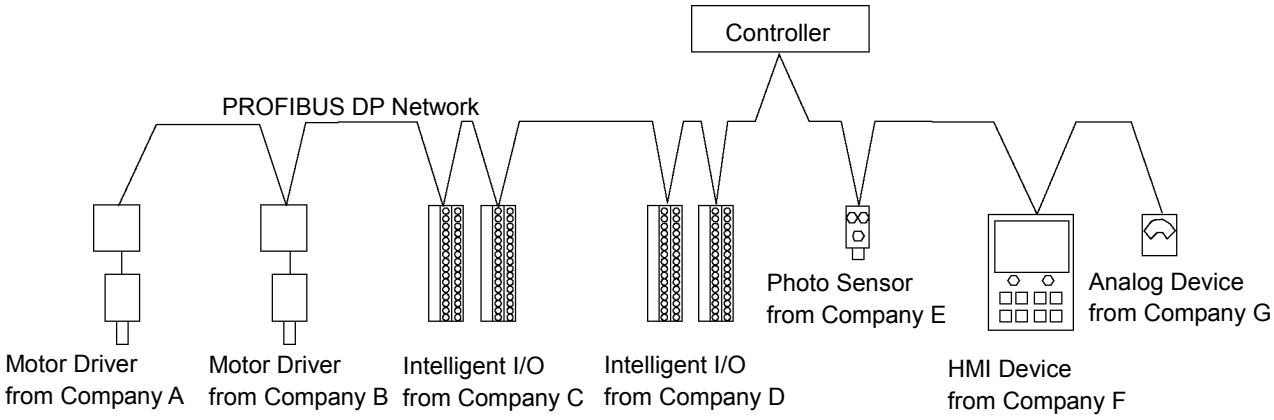
* When thin cable is used for trunk line, the maximum network length is 100 m.

1.3 PROFIBUS DP

Overview of PROFIBUS DP

PROFIBUS DP is one of fieldbus networks that provide easy interconnection between control devices (PLC, PC, sensor, actuator, etc.).

PROFIBUS DP was co-developed by Siemens, Bosch, and ABB as an open communication standard to connect various field devices (sensor, actuator, robot controller, etc.). Because of the open communication standard, PROFIBUS DP can easily construct multi-vendor system with various devices developed around the world.



Features of PROFIBUS DP

Reduced Wiring

Compared with a parallel wiring, PROFIBUS DP employing dedicated 2-wire cable substantially reduces the number of necessary wires, wiring time and cost.

Detachable communication connector provides you a simple wiring between devices (stations) and an easy network separation or reconstruction.

Fast Communication

PROFIBUS DP communication speed can be set up to 12Mbps. This is faster than DeviceNet, another communication standard supported by the fieldbus I/O.

Open Standard (Multi-vendor)

Due to an open communication standard, various devices from many manufacturers are available. Standardized communication connectors allow you to reconstruct your network easily.

The sort of maintenance parts stored on site (factory, etc.) can be reduced because different manufacturers' devices are used in case of a breakdown. Similar products are available around the world due to a global standard PROFIBUS DP.

Large Numbers of Inputs/Outputs

For the standard I/O and expansion I/O, the number of inputs/outputs is limited to up to 512 inputs and 512 outputs. When configuring a device to be a master of fieldbus I/O, you can control more than 16,000 total inputs and outputs.

For a slave device, 1,952 inputs (244 bytes) and 1,952 outputs (244 bytes) are available.

Functions of Master

There are two types of PROFIBUS DP master: DPM1 and DPM2. DPM1 (DP Master Class 1) gathers and controls all stations on one PROFIBUS DP network. DPM2 (DP master Class 2) operates network configurations, network maintenance, and diagnosis.

PROFIBUS DP master can control up to 126 stations (max. 2 kbytes) on one network.

A PLC is typically configured as a master and controls all devices in factory automation system, but EPSON RC+ is also capable of being a master.

PROFIBUS DP network configuration is specified by configuration management software. This software is normally provided by a master device manufacturer. The configuration management software determines parameters for each slave device via an Electronic Data Sheet (GSD).

The connection type is token passing procedure and master-slave communication. The token passing procedure is applied to the PROFIBUS DP network with more than two master devices to transfer network control between masters. The master-slave communication is applied to the communication between the master device with network control and its slave devices.

Available baud rates are 9.6 kbps, 19.2 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1500 kbps, 3 Mbps, 6 Mbps, and 12 Mbps.

Functions of Slave

A slave can exchange data with a master device.

The configuration management software identifies parameters of each slave device via an electronic data sheet (GSD) file where the parameters are registered.

The communication type is a cyclic master-slave communication.

The input/output data of each station is up to 244 bytes.

Available baud rates are 9.6 kbps, 19.2 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1500 kbps, 3 Mbps, 6 Mbps, and 12 Mbps.

General Specifications

Electrical Specifications

Item	Specification
Supply Voltage	5 V DC (supplied from a controller)
Power Consumption	5.5 W
Ambient Temperature during Operation	5-40 deg C
Relative Humidity during Operation	20-80%

PROFIBUS DP Communication Specifications

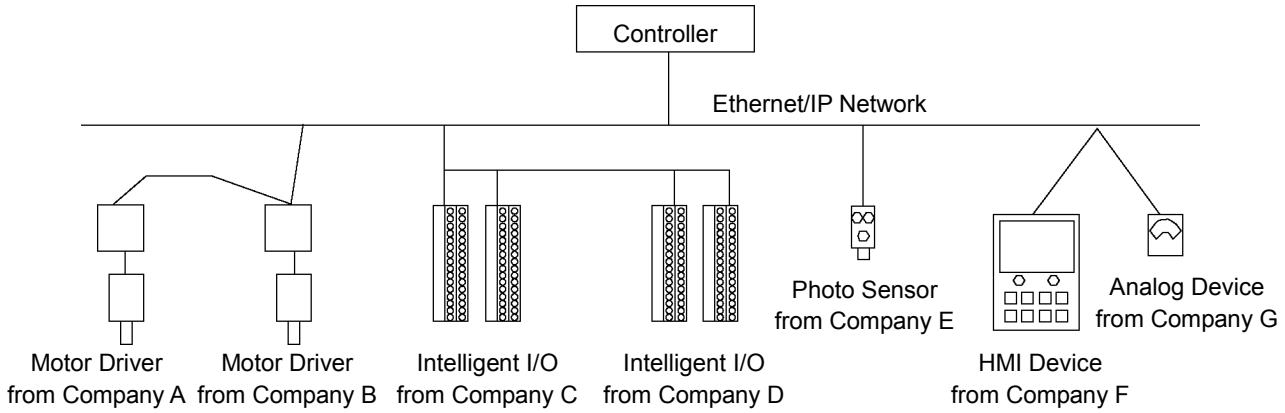
Item	Specification	
Connection Method	Hybrid (token passing procedure and master-slave communication)	
Baud Rates	9.6 kbps, 19.2 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1500 kbps, 3 Mbps, 6 Mbps, and 12 Mbps.	
Transfer Distance	Baud Rates	Cable Length
	12 Mbps	100 m
	6 Mbps	100 m
	3 Mbps	100 m
	1500 kbps	200 m
	500 kbps	400 m
	187.5 kbps	1000 m
	93.75 kbps	1200 m
	19.2 kbps	1200 m
	9.6 kbps	1200 m
Maximum Stations	126 (including master unit and repeater)	
Data Length / Frame	244 bytes	
Cable	2-wire cable dedicated to PROFIBUS (2 wires for signal)	

1.4 EtherNet/IP

Overview of EtherNet/IP

EtherNet/IP is a fieldbus network that provides easy interconnection between control devices (PLC, PC, sensor, actuator, etc.).

EtherNet/IP was developed by Allen-Bradley as an open communication standard to connect various field devices (sensor, actuator, robot controller, etc.). Because of the open communication standard, EtherNet/IP users can easily construct a multi-vendor system with various devices developed around the world.



Features of EtherNet/IP

Reduced Wiring

Compared with parallel wiring, EtherNet/IP employs a standard Ethernet cable which substantially reduces the number of necessary wires, wiring time and cost.

Detachable communication connectors provide you with simple wiring between nodes and easy network separation or reconstruction.

Specified environment-resistance cables allow you to construct an environment-resistant system at low cost.

NOTE

You can use the generic Ethernet hub or Ethernet switch for the EtherNet/IP. However, be sure to a use product complying with the industrial standards or noise resistant Ethernet cable (STP cable). If you use an office use product or UTP cable, it may causes communication errors and may not offer the proper performance.

Open Standard (Multi-vendor)

Due to an open communication standard, various devices from many manufacturers are available. Standardized communication connectors provide you with easy network construction.

The maintenance spare parts stored on site (factory, etc.) can be reduced because different manufacturers' devices are used in case of a breakdown. Similar products are available around the world due to a global standard EtherNet/IP.

Large Numbers of Inputs/Outputs

For EPSON RC+ standard I/O and expansion I/O, the number of inputs/outputs is limited to 512 inputs and 512 outputs. When configuring a device to be a master of fieldbus I/O, you can control more than 16,000 total inputs and outputs.

For a slave device, 4,040 inputs (505 bytes) and 4,072 outputs (509 bytes) are available.

Different Connection Types

There are two messaging connections: I/O messaging connection and explicit messaging connection. The I/O messaging connection includes cyclic and change of state. I/O messaging connections are explained below:

Change Of State:
A device sends data whenever it changes. Signals for device diagnosis are sent regularly in the background. This connection type is useful for remedying EtherNet/IP communication traffic.

Cyclic: A slave device transfers data regularly according to its internal timer. This connection type is typically used for communicating with a temperature controller. The data transfer frequency is defined by master configuration.

NOTE

For Change of State and Cyclic, you can disable the ACK that is for verifying that communication is completed. Never disable ACK, since communication errors cannot be detected.

Functions of Master

The Master device gathers and controls all nodes on one network.

A EtherNet/IP master can control up to 127 nodes (max. 14 kbytes) on one network.

A PLC is typically configured as a master and controls all nodes in factory automation system, but EPSON RC+ is also capable of being a master.

EtherNet/IP network configuration is specified by configuration management software. This software is normally provided by a master device manufacturer. The configuration management software determines parameters for each slave device via an Electronic Data Sheet (EDS).

Available connection types are Cyclic, Change Of State, and explicit messaging.

Available baud rates are 100 Mbps and 10 Mbps. (auto-detect)

Functions of Slave

A slave can exchange data with a master device.

The configuration management software identifies parameters of each slave device via Electronic Data Sheet (EDS) where the parameters are registered.

Available connection type is Cyclic.

Available baud rates are 100 Mbps and 10 Mbps. (auto-detect)

General Specifications

Electrical Specifications

Item	Specification
Supply Voltage	5 V DC (supplied from a controller)
Power Consumption	5.5 W
Ambient Temperature	5-40 deg C
Relative Humidity	20-80%

EtherNet/IP Communication Specifications

Item	Specification
Supported Connection	- I/O messaging connection (Cyclic, Change of State) - Explicit messaging connection All connections are conformed to EtherNet/IP communication protocol.
Baud Rates	100 Mbps, 10 Mbps
Maximum Nodes	128 (including master unit)
Data Length / Frame	244 bytes
Access Control Type	CSMA/CD
Cable	Universal Ethernet cable

2. Installation

This chapter contains procedures for installing a DeviceNet, PROFIBUS DP, or EtherNet/IP network. Refer to the sections that correspond to the type of network you are installing.

2.1 How to Setup a DeviceNet Network

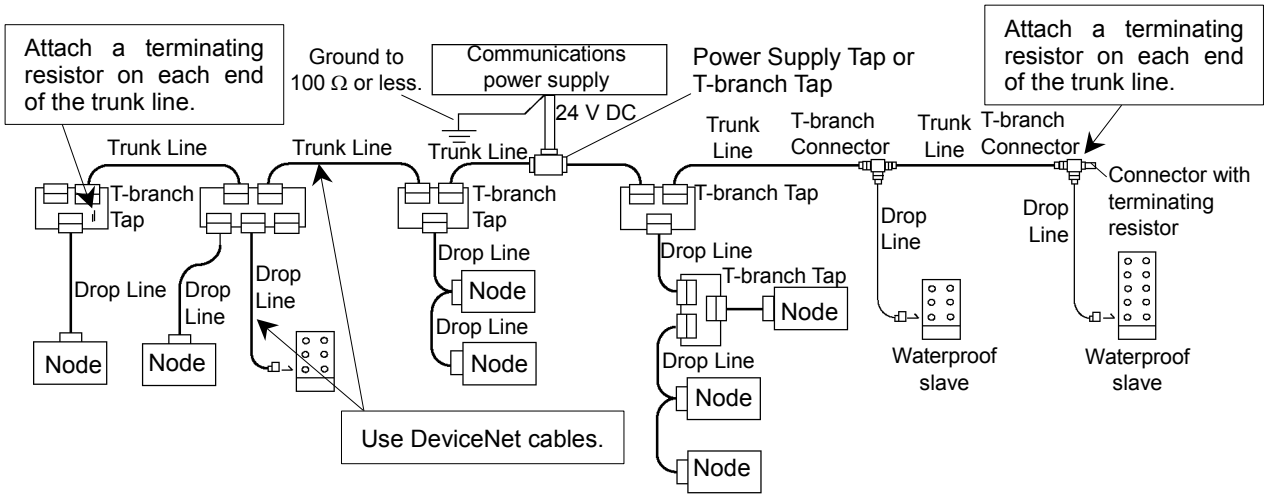
The following is a basic procedure for setting up a DeviceNet network:

1. Choose node distribution and distribution route on your network.
   For details, refer to the following section *2.2 DeviceNet Network Construction*.
2. Choose power supply method for communication.
   For details, refer to the following section *2.2 DeviceNet Network Construction*.
3. Choose baud rate.
   Choose the baud rate based on the network length. Select the fastest baud allowed for the length. Increasing network load due to slow baud rate may cause trouble including communication failure.
4. Lay cables.
   For details, refer to the following section *2.2 DeviceNet Network Construction*.
5. Configure nodes.
   For details, refer to respective manuals of your desired nodes.
6. Turn ON the communications power supply and nodes.
   Turn ON the communications power supply. After that or simultaneously, turn ON the nodes to supply power. When the power to the nodes is supplied earlier than the power to the communications power supply, communication with the nodes may fail.
7. Install the scanner board in your controller.
   Refer to the section *2.7 DeviceNet Board Installation* later in this chapter.
8. Configure a master and slaves.
   Use the configuration management software for configuring a master and slaves (scan list). For details, please refer to the configuration management software manual.
   To configure EPSON RC+ as a master, refer to the section *2.7 DeviceNet Board Installation* later in this chapter.
9. Configure EPSON RC+.
   Refer to the section *2.10 EPSON RC+ Fieldbus I/O Installation* later in this chapter.
10. Operate the DeviceNet network.

2.2 DeviceNet Network Construction

Network Configuration

A DeviceNet network is configured as shown in the following figure.



Node

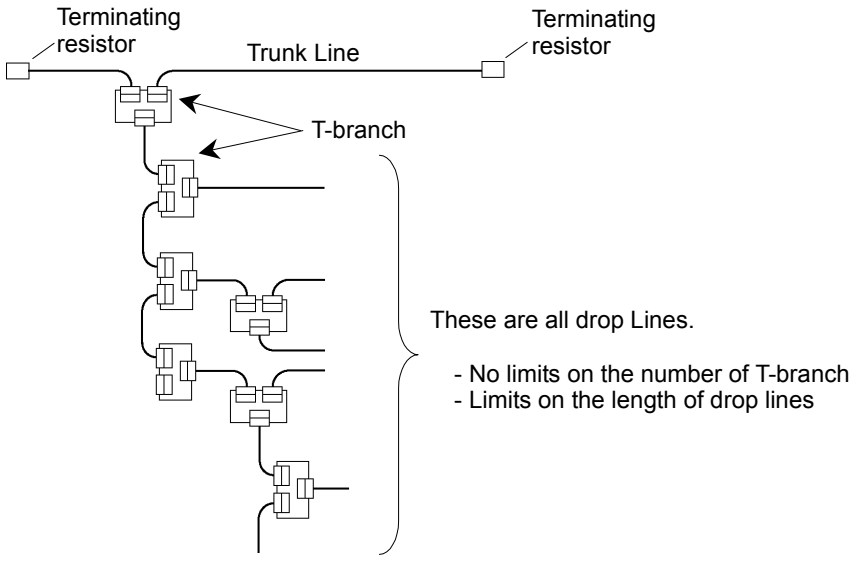
There are two types of the node: master and slave. The master controls a network and gathers data from its slaves. The slaves, including external I/O and other devices, output data in response to the master's output order and informs the master of its input status.

You can install masters anywhere in the network. You can connect up to 64 nodes (including the master) on your network.

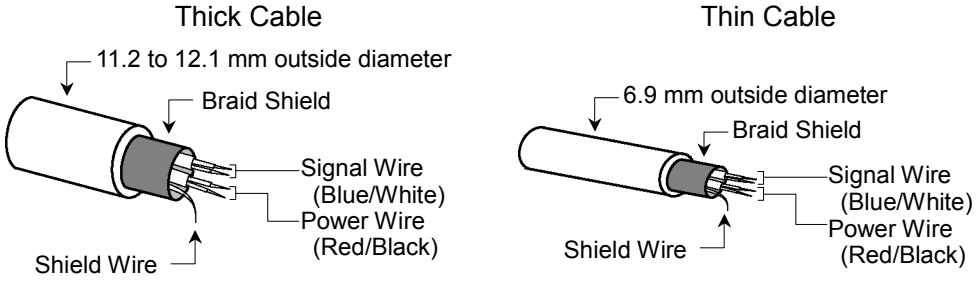
Trunk Line and Drop Line

A trunk line is a backbone cable of DeviceNet network with a terminating resistor on the both ends.

A drop line is a branch of the trunk line.



For DeviceNet, 5-wire cables are used for trunk lines and drop lines. The DeviceNet cables on the market can be used for such cables. There are two types of the DeviceNet cable: Thick cable and Thin cable. Environment-resistant cable and flexible cable are available. For details of cables, see ODVA's Web site (http://www.odva.org/).



Communication Cable Signal

Wire Type	Color	Details of Signal	Wire Identity
Signal wire	Blue	Signal Low	CAN L
	White	Signal High	CAN H
Power wire	Red	Communications Power Positive	V+
	Black	Communications Power Negative	V-
Shield wire	-	Shield	S

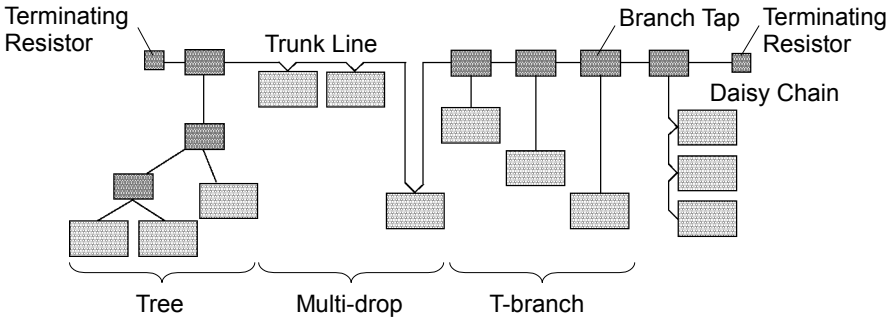
Terminating Resistor

To reduce reflections of communication signal, terminating resistors should be attached on both ends of the trunk line. For DeviceNet, nodes have no terminating resistor on the ends.

Attach 121 Ω +/-1%, 1/4W terminating resistors between the signal wires (CAN-H and CAN-L) of the trunk line cable. Some T-branch taps and connectors can accept terminal resistors. Molded terminating resistors with connectors are also available to attach to environment-resistant T-branch taps and connectors.

Node Connection

Nodes can be connected to a DeviceNet network by the following topologies: tree, multi-drop, T-branch, daisy chain. For tree topology, there is no limitation of daisy chain layer but drop line length is limited. For details of drop line length, refer to the following section “Drop Line Length”.



Communications Power Supply

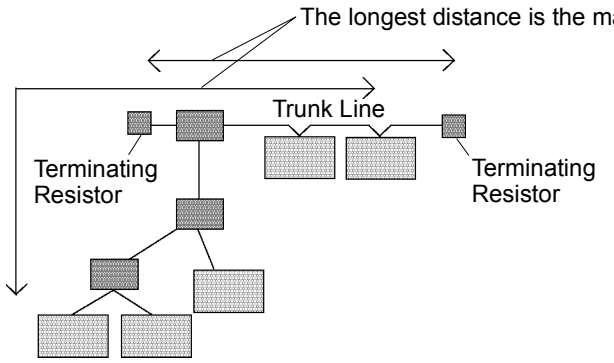
DeviceNet supplies 24V DC communications power to each node via 5-wire cables. You can install the communications power supply at any location on the DeviceNet network. We recommend providing a dedicated communications power supply on the network separately even though it is possible to share power among the communications power supply, node internal circuit power supply, and I/O power supply.

Shield Ground of Signal Wire

Ground the DeviceNet network at one point with 100 Ω or less.
As a noise countermeasure, you can leave the network ungrounded. For details, refer to the *4. Troubleshooting*.

Maximum Network Length (Maximum Trunk Length)

The maximum network length is the longest distance either between terminating resistors or between the two most distant nodes on the network.



The maximum network length is restricted by the type of cable and the baud rate.

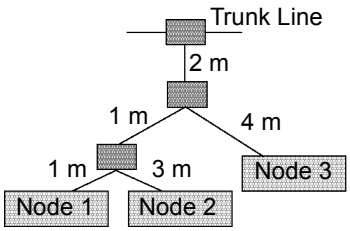
Baud Rate	Maximum Network Length	
	Thick Cable	Thin Cable
500 kbps	100 m	100 m
250 kbps	250 m	100 m
125 kbps	500 m	100 m

Both Thick Cable and Thin Cable can be combined and used for trunk lines. In this case, the maximum network length is calculated using the following formulas.

Baud Rate	Maximum Network Length
500 kbps	Thick Cable Length + Thin Cable Length ≤ 100m
250 kbps	Thick Cable Length + 2.5 × Thin Cable Length ≤ 250m
125 kbps	Thick Cable Length + 5.0 × Thin Cable Length ≤ 500m

Drop Line Length

The drop line length is the distance from a branch on the trunk line to the end of that branch.

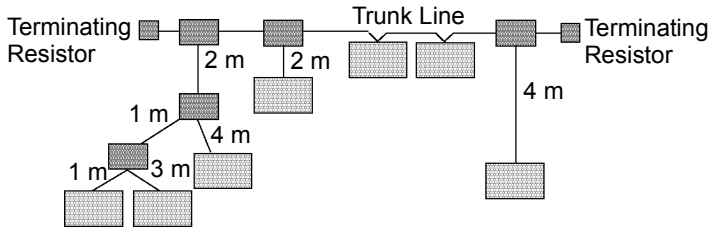


In figure above, each drop line length is as follows:
Drop Line to Node 1: 4 m
Drop Line to Node 2: 6 m
Drop Line to Node 3: 6 m

One drop line length should be 6m or less.

Total Drop Line Length

The total drop line length is the total distance of all drop lines on one network.



In the figure above, the total drop line length is 17 m.

The maximum total drop line length is restricted by baud rate as shown in the table below. The cable thickness is not related to the restriction.

Baud Rate	Max. Total Drop Line Length
500 kbps	39 m
250 kbps	78 m
125 kbps	156 m

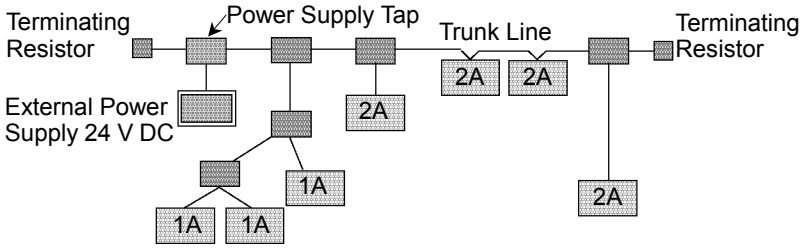
Cable Current Capacity

The current-carrying capacity of the DeviceNet network cable is restricted as shown below:

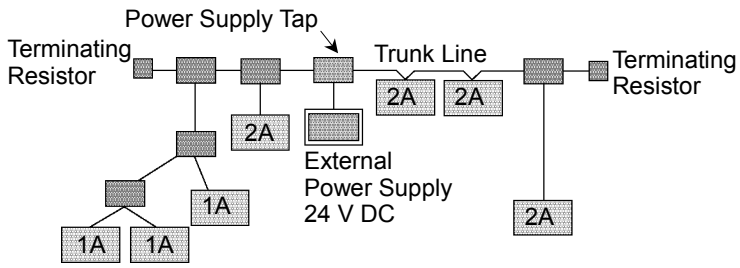
	Trunk Line		Drop Line (Unit: A)
	Thick Cable	Thin Cable	
Current Capacity	8A	3A	4.57 / Drop Line Length (m) ≤ 3A

The following figures illustrate power supply configuration examples.

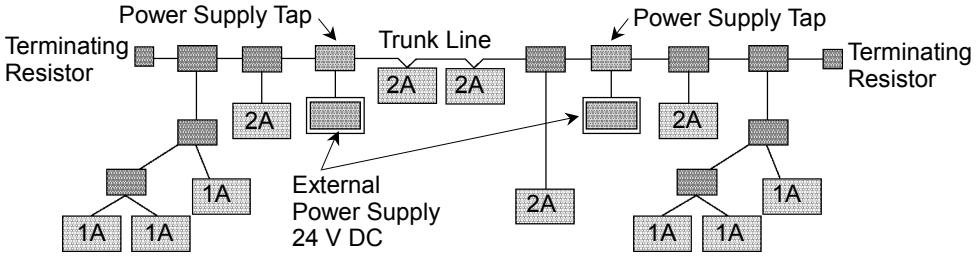
When an external power supply is installed on the network as shown in the figure below, the current capacity is 11A and it exceeds the permissible current of the cable.



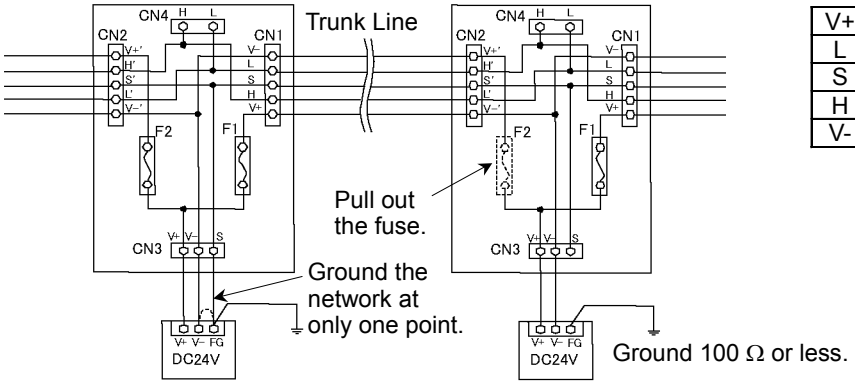
If the location of the external power supply is changed on the network as shown in the figure below, the power supply can be used on the network because the current capacity on the left side of the power supply tap is 5 A and that on the right side is 6 A.



If the current capacity consumed on the network exceeds the restriction of cable current capacity, it is possible to install more than one power supply on the network. If you attempt to install two or more power supplies on the network, take necessary measures (pulling out a fuse on the power supply tap, etc.) to avoid conflicts between power outputs from multiple power supplies.



The following figure illustrates a sample wiring. An OMRON power supply tap is shown in the figure.



V+	V+
L	CAN L
S	Shield
H	CAN H
V-	V-

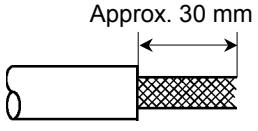
CAUTION	■ Carefully connect the wires. Incorrect wiring may cause node malfunction and severe damage to the entire DeviceNet network.

Procedure for Modifying and Installing Communication Cables

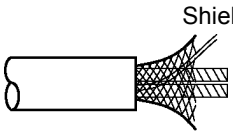
Follow the steps described below to modify communication cables and connect them to connectors.

CAUTION	■ Be careful not to injure your hands or fingers on any sharp blades or tools used to modify the cable. Use appropriate blades and/or other tools to modify the cable. Using inappropriate blades and/or other tools may result in bodily injury and/or equipment damage.

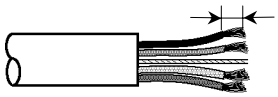
(1) Strip approx. 30 mm of the cable covering with extra care so that you do not scratch on the braided shield underneath. Do not strip the cable covering more than necessary. Excess stripping may cause short-circuit and/or make the cable more sensitive to noise.



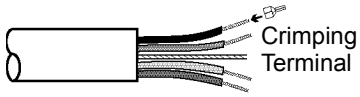
(2) Carefully expand the meshes of the braided shield. Under the braided shield, there is one exposed bare twisted shield wire other than the signal wires and power wires that are wrapped with aluminum tape. The shield wire is slightly harder than the mesh.



(3) Cut off the expanded braided shield and remove the aluminum tape around the signal wires and power wires. Then, strip the insulation from the signal wires and power wires for a length sufficient to connect them to crimp terminals.
Twist each stripped signal wire and power wire.



(4) Set the crimp terminal on the stripped part of the wire and crimp it with a crimp tool. The following crimping terminals are recommended products.



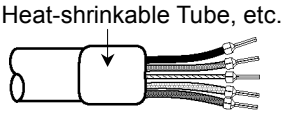
NICHIFU TC series

Model Number	Specifications	Special Tool
TMEV TC-0.5	For Thin Cable	MH-32
TMEV TC-2-11	For Thick Cable (power wire)	
TMEV TC-1.25-11	For Thick Cable (signal wire)	

Phoenix Contact AI series

Model Number	Specifications	Special Tool
AI 0.5-8WH	For Thin Cable (power cable)	CRIMPFOX UD6
AI 0.25-8YE	For Thin Cable (signal wire)	
AI 2.5-8BU	For Thick Cable (signal wire)	
AI 1-8RD	For Thick Cable (signal wire)	

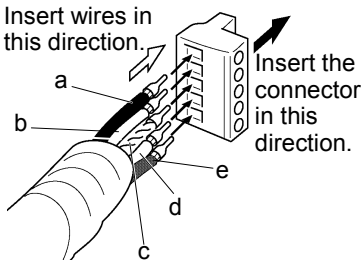
(5) Wrap or cover the cable with vinyl tape or heat-shrink tubing.



NOTE

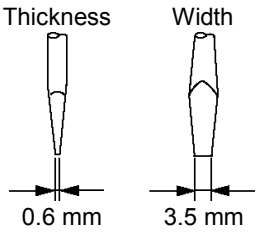
Loosen the screws securing the cables on the connector. If the screws are not loosened, the wires go into different openings on the rear of connector instead of the correct openings and the wires cannot be secured.

(6) Ensure the correct connector orientation and insert the signal wires and shield wire to their respective holes on the connector.
As shown in the figure, insert the wires (black, blue, shield, white, and red) into the holes in the order named.
The following table shows the specified colors of the cables.



	Color	Details of Signal	Wire Identity
a	Black	Communications Power Supply (negative)	V-
b	Blue	Signal (Low)	CAN L
c	-	Shield	S
d	White	Signal (High)	CAN H
e	Red	Communications Power Supply (positive)	V+

(7) Tighten each screw securing the wires on the connector.
Tighten the screw securing the wire at a correct tightening torque (0.25 to 0.3 N·m). To prevent thick cable from coming out due to cable tension, install enough thick cable length to allow for stretch.
Use a small flat blade screwdriver that has the correct width and thickness. If you use a typical screwdriver whose point is narrow, you cannot deeply insert it into the hole on the connector.
Specific screwdriver for DeviceNet connector screw:
OMRON : XW4Z-00C
Phoenix Contact : SZF-1 0.6×3.5



2.3 How to Setup a PROFIBUS DP Network

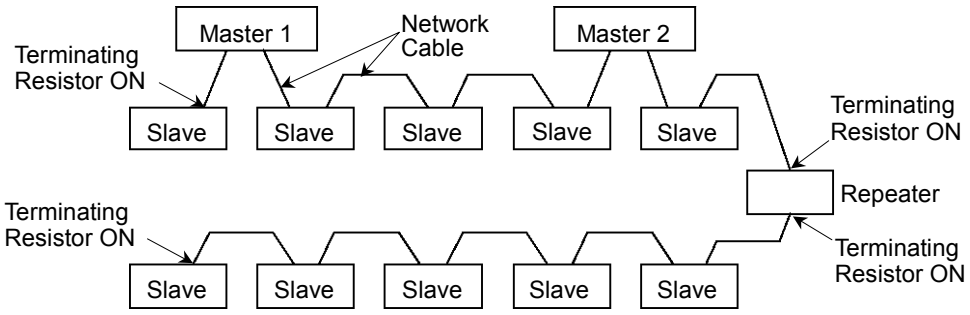
The following is a basic procedure for setting up a PROFIBUS DP network:

1. Choose station distribution and distribution route on your network.
   For details, refer to the following section *2.4 PROFIBUS DP Network Construction*.
2. Choose baud rate.
   Choose the baud rate based on the network length. Select the fastest baud rate allowed for the length. Increasing network load due to slow baud rate may cause trouble including communication failure.
3. Lay cables.
   For details, refer to the following section *2.4 PROFIBUS DP Network Construction*.
4. Configure stations.
   For details, refer to respective manuals of your desired stations.
5. Turn ON the stations.
6. Install the scanner board in your controller.
   Refer to the section *2.8 PROFIBUS DP Board Installation* later in this chapter.
7. Configure a master and slaves.
   Use the configuration management software for configuring a master and slaves (scan list). For details, please refer to the configuration management software manual.
   To configure EPSON RC+ as a master, refer to the section *2.8 PROFIBUS DP Board Installation* later in this chapter.
8. Configure EPSON RC+.
   Refer to the section *2.10 EPSON RC+ Fieldbus I/O Installation* later in this chapter.
9. Operate the PROFIBUS DP network.

2.4 PROFIBUS DP Network Construction

Network Configuration

A PROFIBUS DP network is configured as shown in the following figure.



Station

There are four types of stations (devices): master, slave, repeater, and configurator.

The master controls a network and gathers its slaves.

The slave, including external I/O and other devices, outputs data as a response to a master's output order and informs the master of its input status.

The repeater is necessary for a network with more than 32 slaves to separate network segments.

The configurator, used only for network installation, configures a scan list of the slaves on the master device.

You can install masters anywhere on the network. You can connect up to 126 stations including server and repeater on your network. However, we recommend you to use one device for the engineering device.

Network Cable

The PROFIBUS cable can be used as a network cable. There are four types (A, B, C, D) of PROFIBUS cables. Normally, cable type A is used for a PROFIBUS DP network. The cable type A specifications are shown in the table below.

Item	Specification
Impedance	135 to 165 Ω
Capacity	< 30 pf/m
Loop resistance	110 Ω/km
Wire diameter	0.64 mm
Core cross-section	> 0.34 mm^2

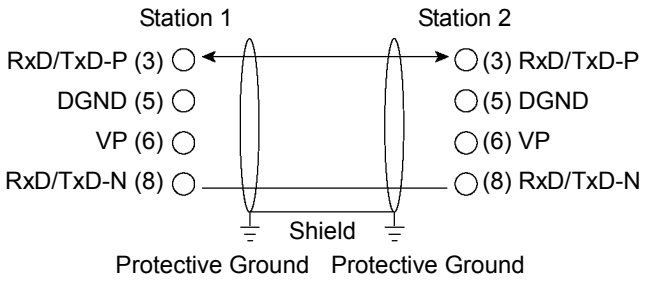
It is recommended that a 9-pin D-Sub connector be used for protecting rating IP 20. For IP 65/67, M12 connector in accordance with IEC 947-5-2, Han-Bird connector in accordance with DESINA, and Siemens hybrid connector are available.

Pin assignment (9-pin D-Sub)

Pin No.	Signal	Assignment
1	Shield	Shield / Protective ground
2	M24	Ground of output voltage (24 V)
3	RxD/TxD-P	Data line B
4	CNTR-P	Repeater control signal (directional control)
5	DGND	Communications power supply (5 V)
6	VP	Supply voltage to terminating resistor (P5V)
7	P24	Output voltage (24 V)
8	RxD/TxD-N	Data line A
9	CNTR-N	Repeater control signal (directional control)

Use pins 2 and 7 for connecting a maintenance device without any power supply.

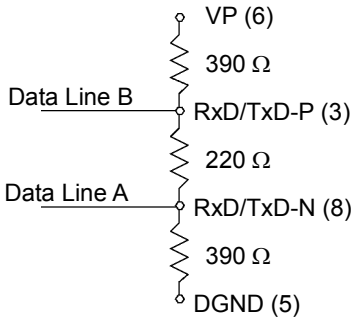
The following figure illustrates wiring.



Different manufacturers produce a wide range of PROFIBUS cables. For details of the PROFIBUS cables, see PROFIBUS International's website (http://www.profibus.com/).

Terminating Resistor

To reduce reflections of communication signal, terminating resistors should be attached on both ends of each segment. Attach the terminating resistor as shown below.



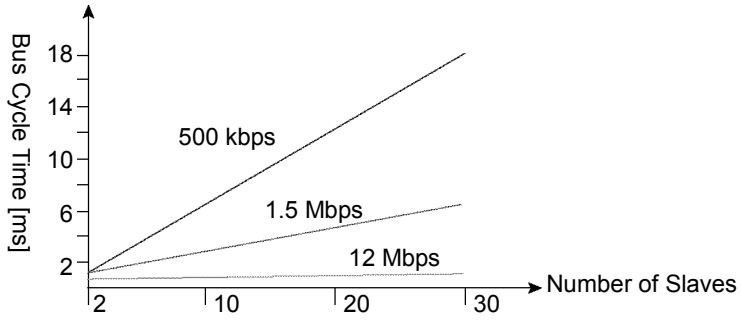
Some PROFIBUS 9-pin D-Sub connectors on the market have functions of terminating resistor and they can enable / disable the terminating resistor. (Example: Woodhead MA9D00-32)

Molded terminating resistors with connector are also available to attach them to environment-resistant M12 connector.

Baud Rate and Maximum Cable Length

Available baud rates are 9.6 kbps, 19.2 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1500 kbps, 3 Mbps, 6 Mbps, and 12 Mbps.

PROFIBUS DP requires approximately 1ms at 12 Mbps for the transmission of 512 bits input data and 512 bits output data distributed over 32 stations. The following figure shows typical PROFIBUS DP transmission times depending on the number of stations and baud rate.



The maximum cable length is restricted by the baud rate.

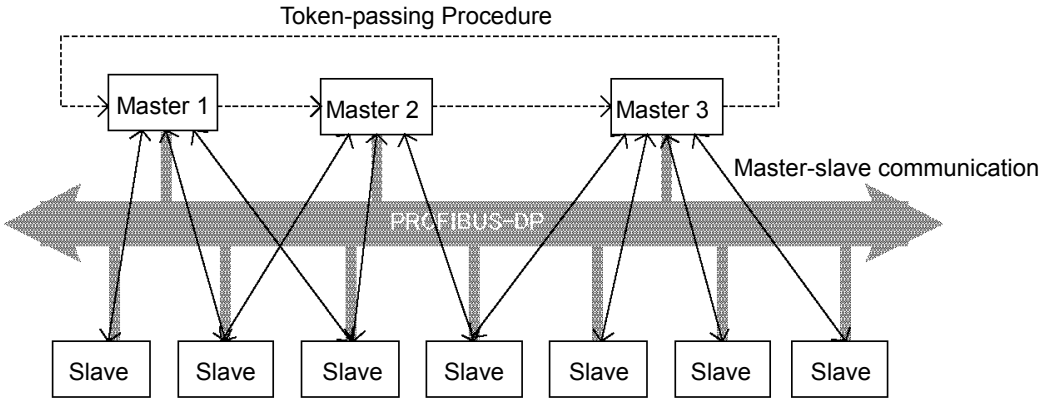
Baud Rate	Maximum Cable Length
12 Mbps	100 m
6 Mbps	100 m
3 Mbps	100 m
1500 kbps	200 m
500 kbps	400 m
187.5 kbps	1000 m
93.75 kbps	1200 m
19.2 kbps	1200 m
9.6 kbps	1200 m

Multi-Master Configuration

PROFIBUS DP allows you to install multiple masters on a single physical network.

All slave devices on the network can be accessed by different masters. Only one master on the network can be used for device configuration.

The following figure illustrates the communication procedure for a multi-master configuration.



When the master receives the logic token, it inquires data from its slaves. After all communications are completed, the master passes the token to another master. In this way, the master can only communicate with its slaves while it is holding the token. The slaves respond to only the inquiry from the master. No slave can output any messages.

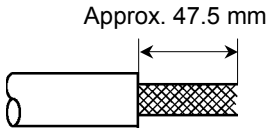
Procedure for Modifying and Installing Communication Cables

The following procedure explains how to modify and install a Woodhead 9-pin D-Sub connector (MA9D00-32).

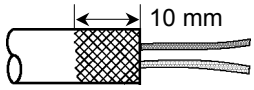
Follow the steps described below to modify communication cables and connect them to the connector.

CAUTION	■ Be careful not to injure your hands or fingers on any sharp blades or tools used to modify the cable. Use appropriate blades and/or other tools to modify the cable. Using inappropriate blades and/or other tools may result in bodily injury and/or equipment damage.

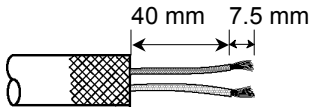
(1) Strip approx. 47.5 mm of the cable covering with extra care so that you do not scratch on braided shield underneath.
Do not strip the cable covering more than necessary. Excess stripping may cause short-circuit and/or make the cable more sensitive to noise.



(2) Carefully expand meshes of the braided shield and fold back the shield over the cable covering. Cut off the shield at approx. 10 mm from the stripped side of the cable covering.



(3) Strip the covering of the signal wire as shown in the figure.



(4) Insert the signal wires into the terminal block on the connector and secure the signal wires. Carefully connect the same signal wire to the same terminal on both ends.
To prevent faulty wiring, make a rule of connection. For instance, connect the green signal wire to the A1/A2 terminal and the red signal wire to the B1/B2 terminal.

2.5 How to Setup a EtherNet/IP Network

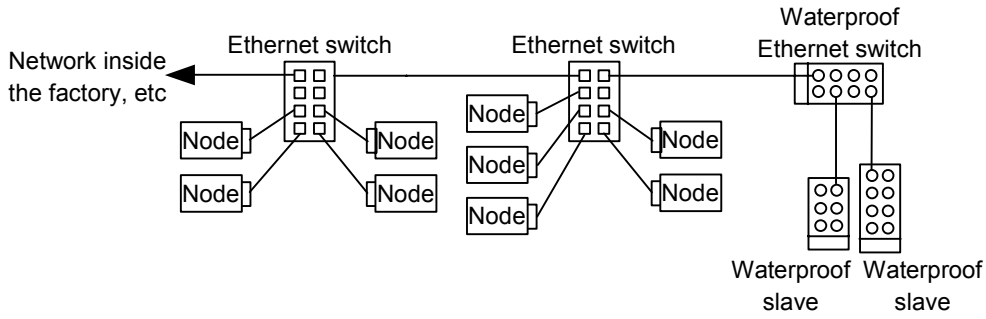
The following is a basic procedure for setting up a EtherNet/IP network:

1. Choose node distribution and distribution route on your network.
   For details, refer to the following section *2.6 EtherNet/IP Network Construction*.
2. Lay cables.
   For details, refer to the following section *2.6 EtherNet/IP Network Construction*.
3. Configure nodes.
   For details, refer to respective manuals of your desired nodes.
4. Turn ON the nodes.
5. Install the scanner board in your controller.
   Refer to the section *2.9 EtherNet/IP Board Installation* later in this chapter.
6. Configure a master and slaves.
   Use the configuration management software for configuring a master and slaves (scan list). For details, please refer to the configuration management software manual.
   To configure EPSON RC+ as a master, refer to the section *2.9 EtherNet/IP Board Installation* later in this chapter.
7. Configure EPSON RC+.
   Refer to the section *2.10 EPSON RC+ Fieldbus I/O Installation* later in this chapter.
8. Operate the EtherNet/IP network.

2.6 EtherNet/IP Network Construction

Network Configuration

A EtherNet/IP network is configured as shown in the following figure.



Node

There are two types of the node: master and slave. The master controls a network and gathers data from its slaves. The slaves, including external I/O and other devices, output data in response to the master's output order and informs the master of its input status.

You can install masters anywhere in the network. One master node can control up to 127 nodes.

Universal Ethernet cable is used for EtherNet/IP. Use a proper cable such as environmental resistance and refraction resistance that fulfills the environment.
For details, see the website of ODVA. (http://www.odva.org/)

Wiring

Wirings are conformed to EtherNet/IP connection protocol.

NOTE

You can use the generic Ethernet hub or Ethernet switch for the EtherNet/IP. However, be sure to a use product complying with the industrial standards or noise resistant Ethernet cable (STP cable). If you use an office use product or UTP cable, it may causes communication errors and may not offer the proper performance.

2.7 DeviceNet Board Installation

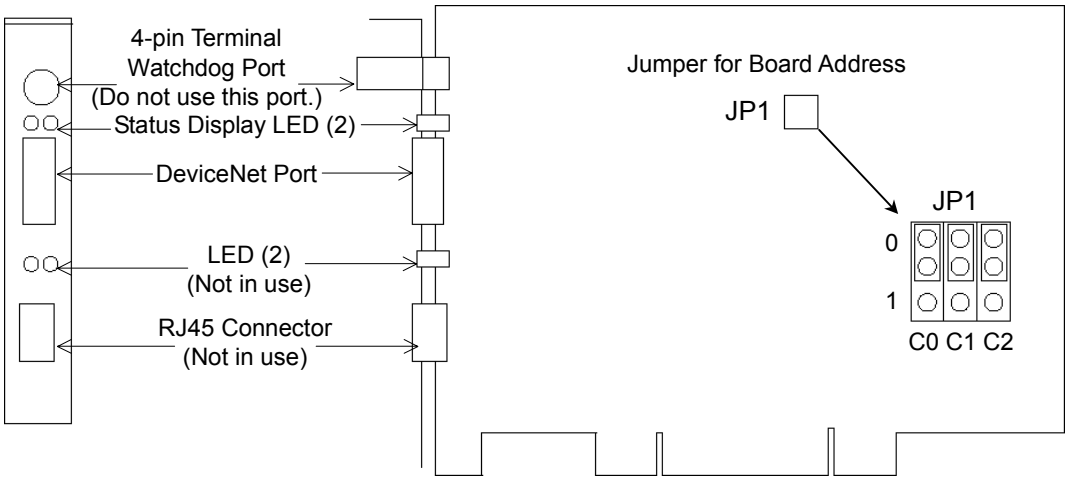
Following two types can be used for the fieldbus I/O option DeviceNet.

- PCU-DVNIO
- PCI-DVNIO

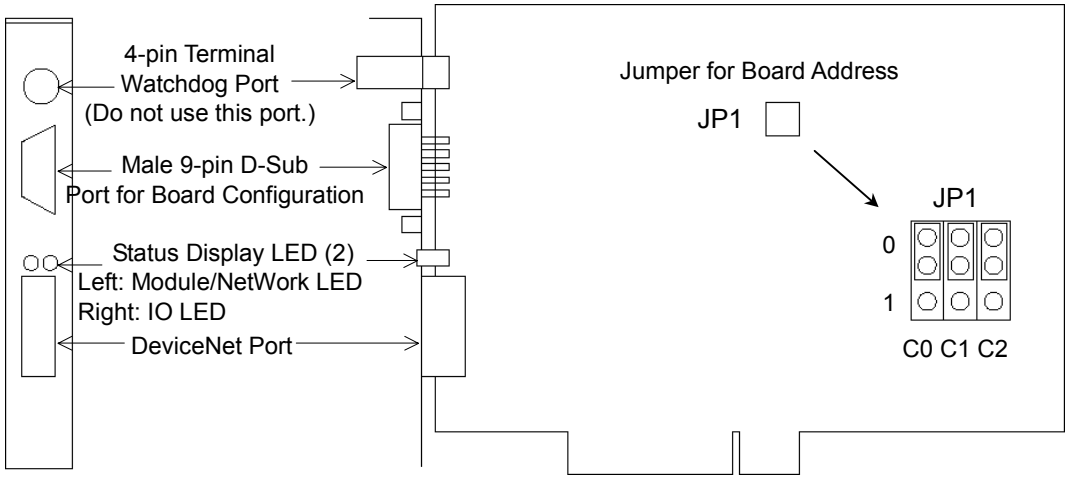
2.7.1 Board Appearance

Part names and functions of the scanner board are shown in the following figure.
For details of the status display LEDs (Module/NetWork LED and IO LED), refer to the *4. Troubleshooting* in this manual.

PCU-DVNIO



PCI-DVNIO



2.7.2 Specifications

Part Number	applicom PCI-DVNIO / PCU-DVNIO
Modes	Master/Slave
Baud rates	125, 250, 500 kbps
Interface	1 DeviceNet port
Supported Devices	Group 2 Only Server and U.C.M.M. capable
Maximum Nodes	63
Connection Types	Strobe, Polling, Cyclic and Change of State
Explicit Messaging	Yes
EDS Support	Yes
Input Data Size	1 to 255 bytes
Output Data Size	1 to 255 bytes
Automatic Detection	Yes. Devices can be detected automatically.

2.7.3 Software Installation

Before installing any boards in your controller, you must install the applicomIO console application and drivers for the type of board you will be using.

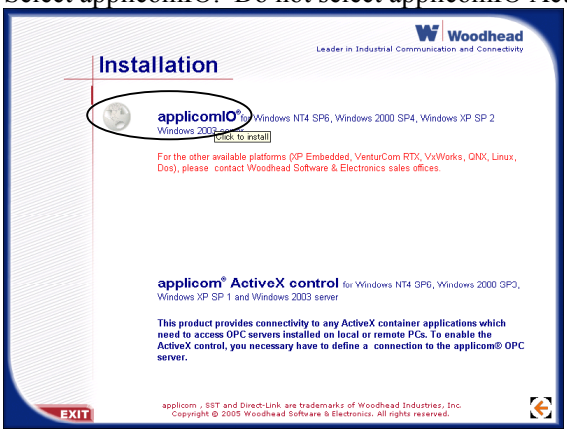
(1) Start the controller.

(2) Run the C:\Install\FieldBus\Install\applicomIO\Disk1\Setup.EXE from the install folder in the controller to start the installation.

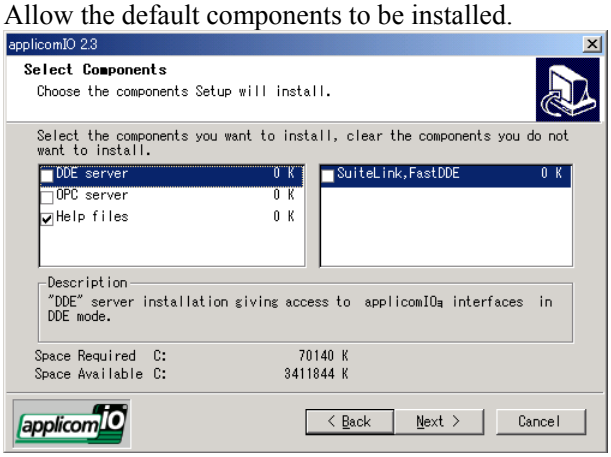
(3) Select the desired language for the installer.

(4) Select Install Products.

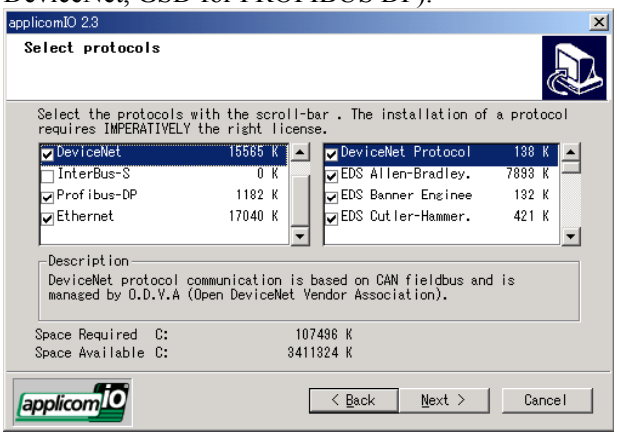
(5) Select applicomIO. Do not select applicomIO ActiveX.



(6) Allow the default components to be installed.



(7) Select the protocol: DeviceNet you will be using. If you also use PROFIBUS DP, select Profibus-DP as well. Select which type of device data files to install (EDS for DeviceNet, GSD for PROFIBUS DP).



(8) Complete the installation.

(9) The message to ensure the restart appears. Click the **Yes** button.

(10) Start the C:\Install\FieldBus\Install\SP\Setup.EXE and install the service pack. No installation is necessary when a service pack is not attached to controller.

(11) After completing the installation of the service pack, shutdown the computer.

(12) Proceed to *2.5.4 Board Installation.*

2.7.4 Board Installation

WARNING	■ Make sure that the power is turned OFF before installing/removing any boards or connecting/disconnecting any cables. Installing/removing any boards or connecting/disconnecting any cables with the power ON is extremely hazardous and may result in electric shock and/or malfunction of equipment.

(1) Configure the board address jumper (JP1) on each board. The board number must start with 1 consecutively. Refer to the following table for JP1 configuration.

Short Socket / Board No.	C0	C1	C2
1	0: Short	0: Short	0: Short
2	1: Short	0: Short	0: Short
3	0: Short	1: Short	0: Short
4	1: Short	1: Short	0: Short
5	0: Short	0: Short	1: Short
6	1: Short	0: Short	1: Short
7	0: Short	1: Short	1: Short
8	1: Short	1: Short	1: Short

(2) Install the board(s) in any available PCI slot in the controller.

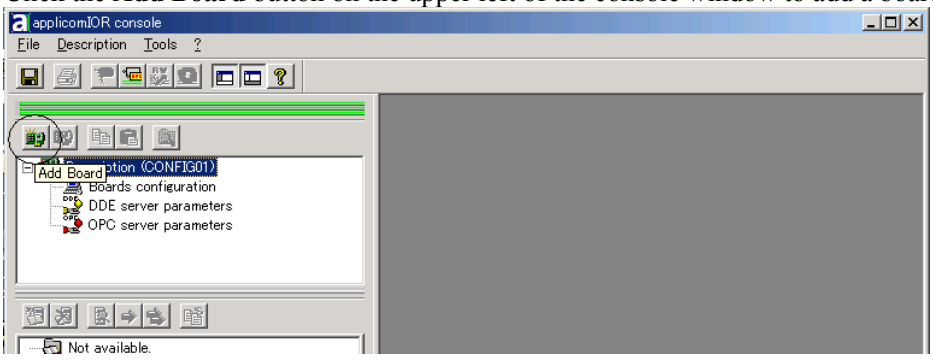
(3) Connect the board(s) to the Fieldbus.

(4) Start the controller.

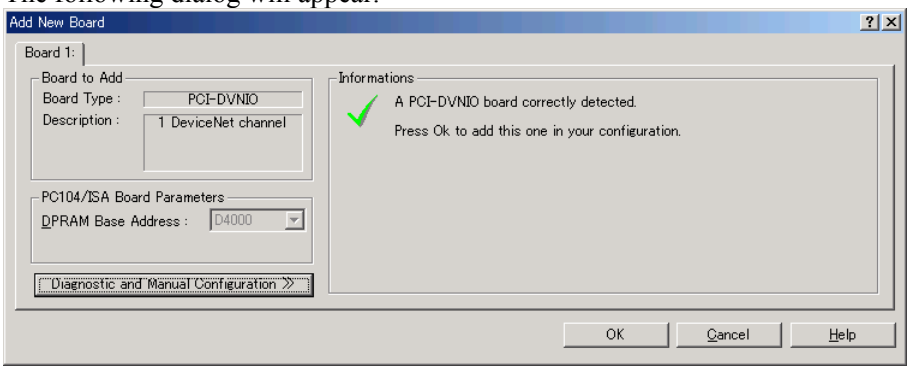
(5) The Windows Hardware Wizard will display a message that the applicomIO board was found and prompt you to restart the computer.
The applicomIO console application will automatically start for this first start after installation. Close this application for now and restart the controller.

(6) Start the applicomIO console application.

(7) Click the **Add Board** button on the upper left of the console window to add a board.

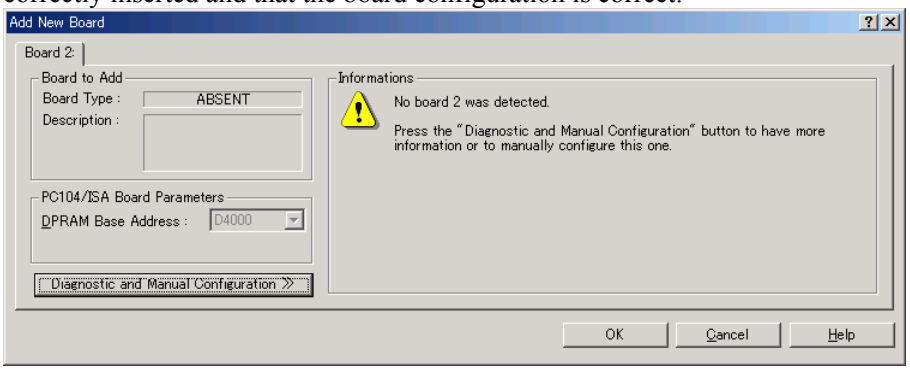


(8) The following dialog will appear.



Check that “PCI-DVNIO” (“PCI-DPIO” or “PCU-DPIO” in case of PROFIBUS DP)

is shown in the **Board Type:** box. Then, click the **OK** button.
When installing more than two fieldbus boards in the system, add all the boards using this dialog.
The following dialog will appear when no board is detected. Ensure that the board is correctly inserted and that the board configuration is correct.



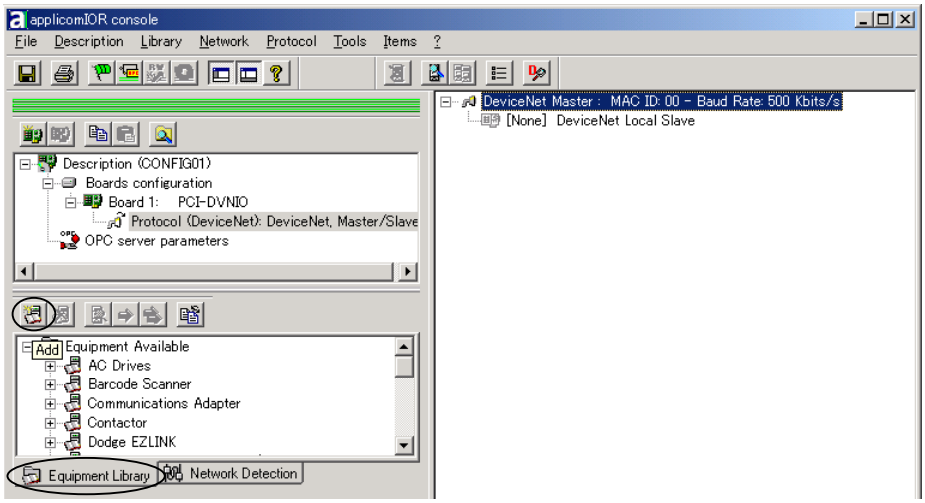
(9) After all the boards are added, the system should be restarted.
Close the applicomIO Console application and click the **OK** button on the **Save modification** dialog. Click the **OK** button on the following dialog to restart Windows.

(10) After restarting the system, continue with the following *2.5.5 Master Mode* or *2.5.6 Slave Mode* sections.

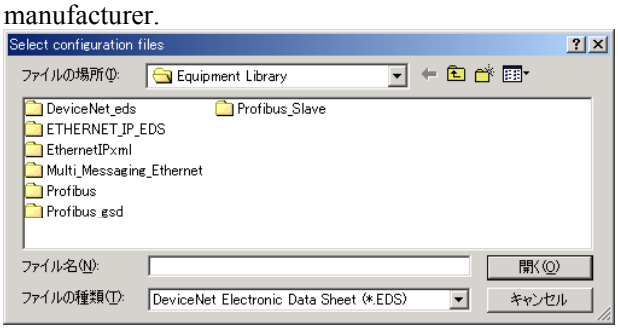
2.7.5 Master Mode

(1) Ensure that the board is connected to the fieldbus. Then, start the applicomIO console application.

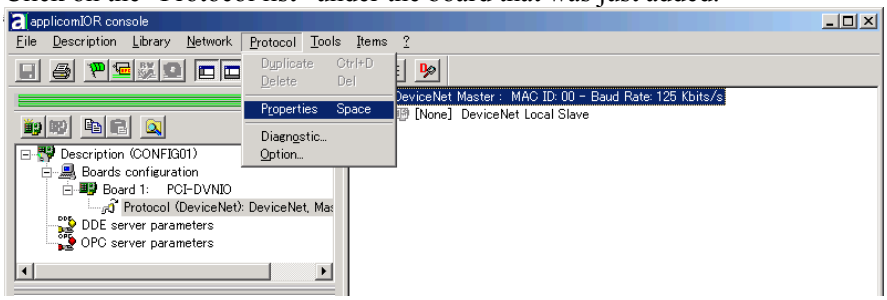
(2) Register the device information (EDS file) that is necessary for the network setup. Select the [Equipment Library] tab at the center of the dialog's right side and click the **Add** icon.



(3) Following dialog appears. Specify the EDS file that is supplied from the device manufacturer.

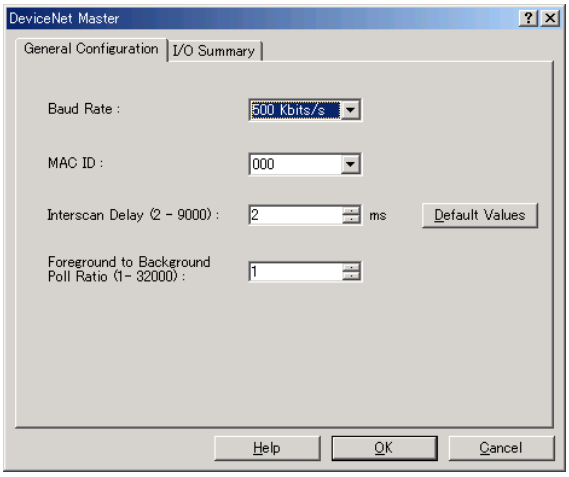


(4) Click on the "Protocol list" under the board that was just added.



(5) Select **Protocol** | **Property**.

(6) Configure the baud rate, MAC ID (master address), and so on for the DeviceNet network.

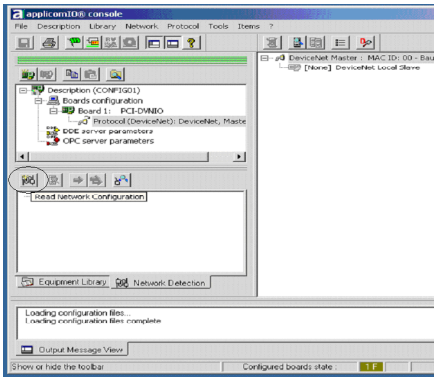


NOTE

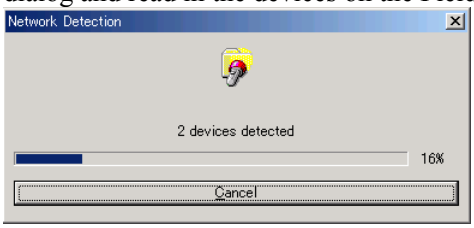
The load on a bus can be controlled by the baud rate and interscan delay settings. When the load exceeds 60%, the DeviceNet network communication will be unstable, for example: more communication errors. Set the configuration to minimize the load.

For the procedure for verifying the load on the bus using the applicomIO Console application, refer to the *4. Troubleshooting* in this manual.

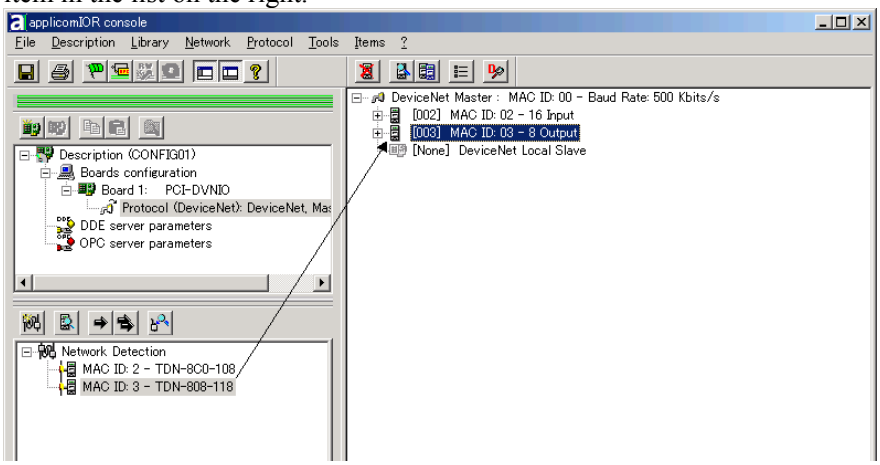
(7) Click the **Network Detection** tab on the center left of the console window.



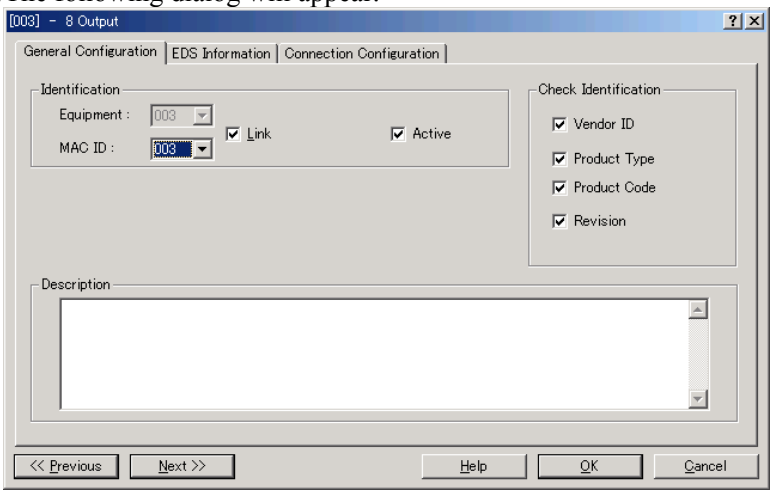
(8) Click the **Read Network Configuration** button to display the **Network Detection** dialog and read in the devices on the Fieldbus.



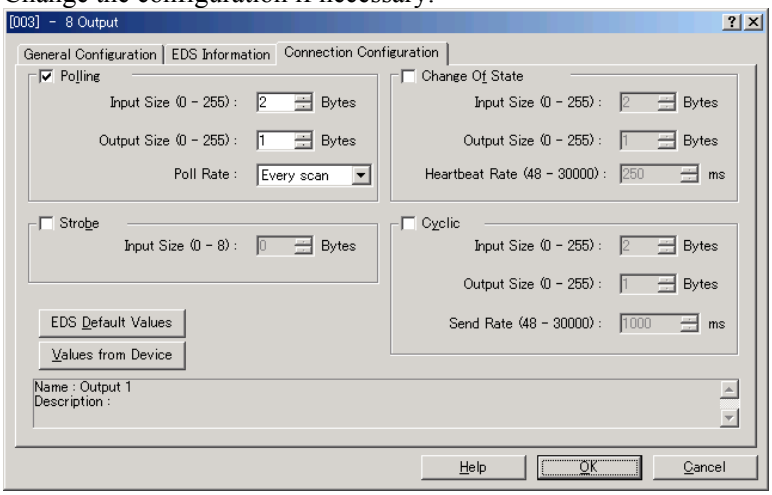
(9) Drag each device you want to scan from the **Network Detection** tab to the Master item in the list on the right.



(10) The following dialog will appear.



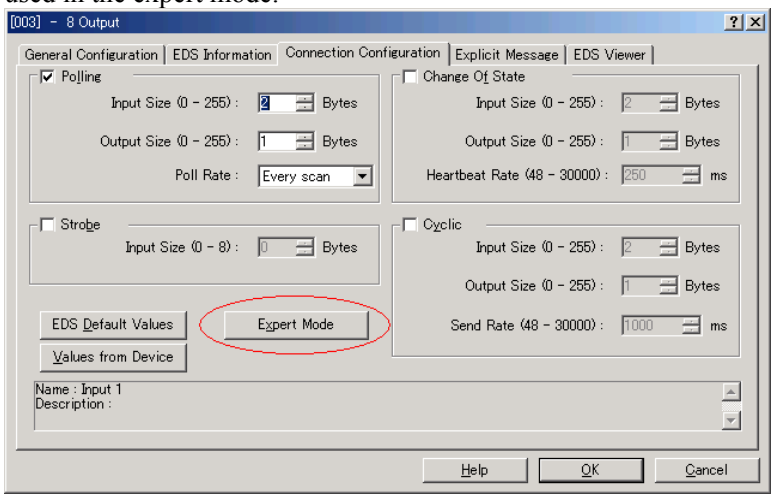
Select the **Connection Configuration** tab to verify the connection configuration. Change the configuration if necessary.



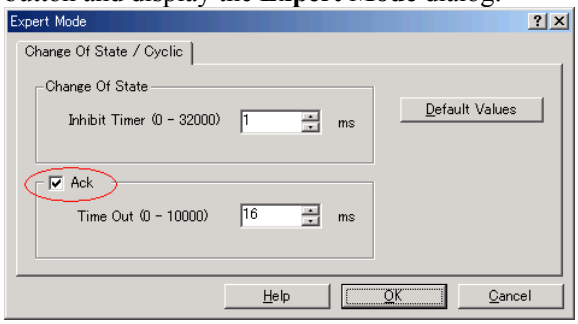
NOTE

Not every slave device supports all connection types. Understand the specifications of the slave device you want to use and configure the connection correctly.

The **Expert Mode** button will appear when the applicomIO Console application is used in the expert mode.



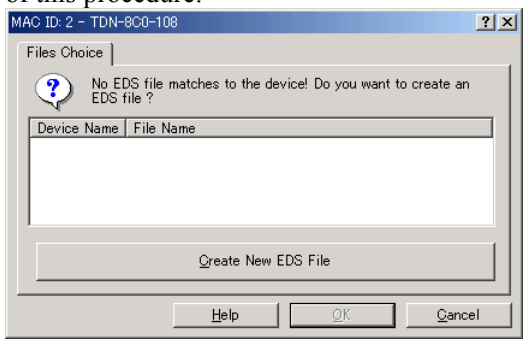
To configure details of "Change Of State" and "Cyclic", click the **Expert Mode** button and display the **Expert Mode** dialog.



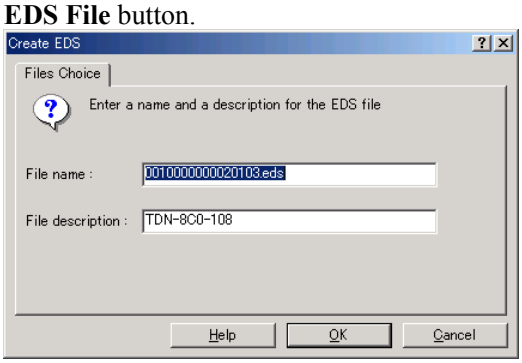
NOTE

Never disable Ack. When the [Ack] checkbox is unchecked, a failed connection is not regarded as an error.

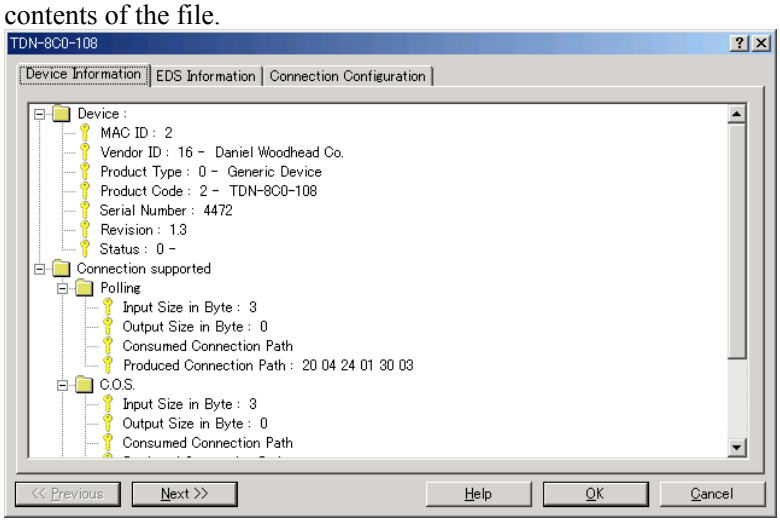
(11) When the system cannot identify the device you want to use (its EDS file is not registered), the following dialog will appear. In this case, obtain the EDS file from the device manufacturer and register it. Then, start from step 5 (Network Detection) of this procedure.



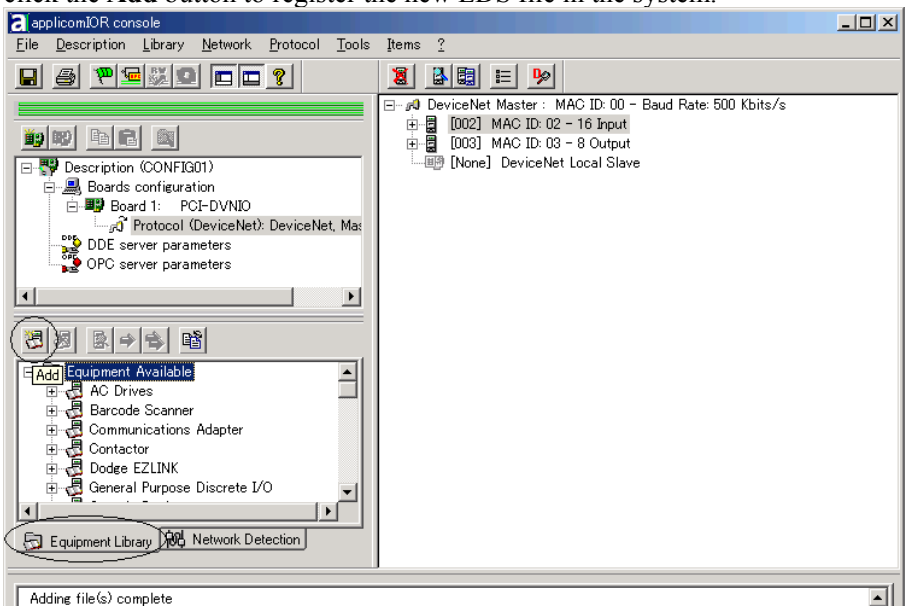
To create a new EDS file based on the data from the device, click the **Create New EDS File** button.



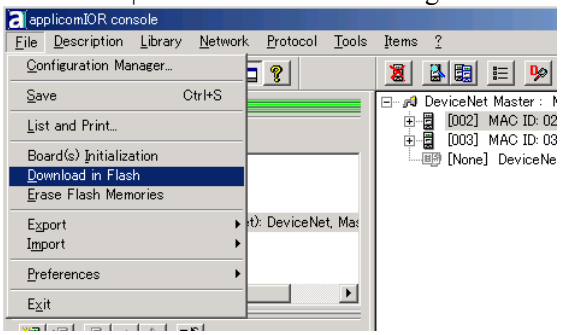
When a new EDS file is created, the following dialog will appear to verify the contents of the file.



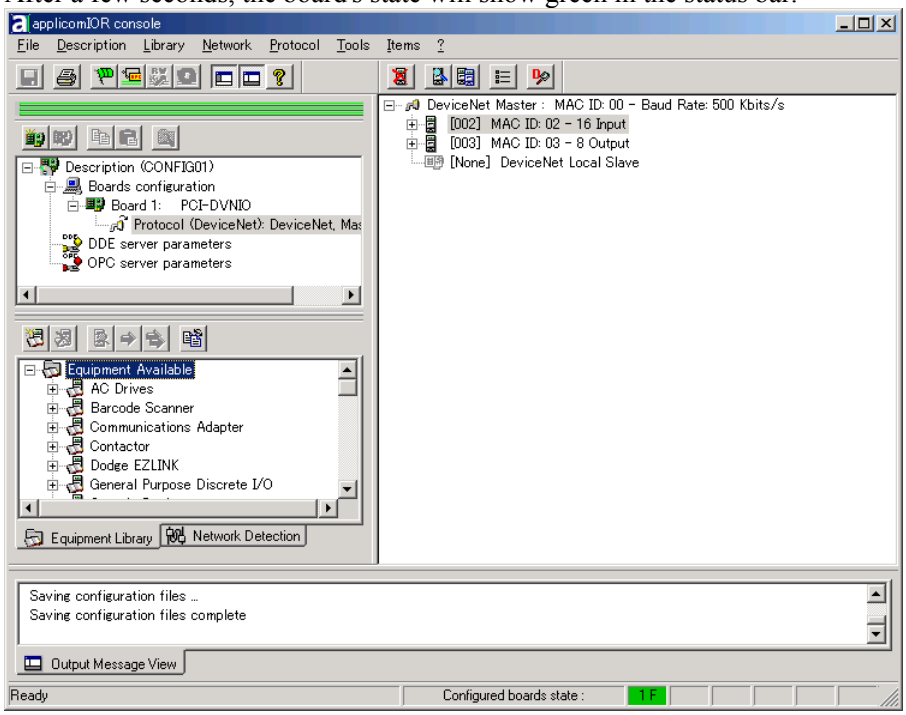
(12) Select the **Equipment Library** tab on the center left of the console window and click the **Add** button to register the new EDS file in the system.



(13) Select **File** | **Download in Flash** to register the configuration in the fieldbus board.



After a few seconds, the board's state will show green in the status bar.

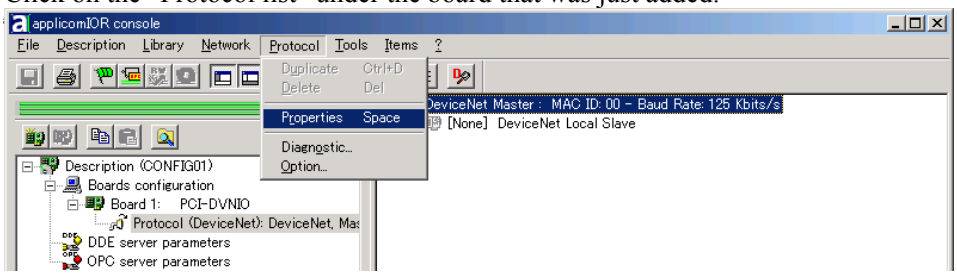


(14) Now, the fieldbus board is ready to operate as a master. Close the applicomIO Console application.

2.7.6 Slave Mode

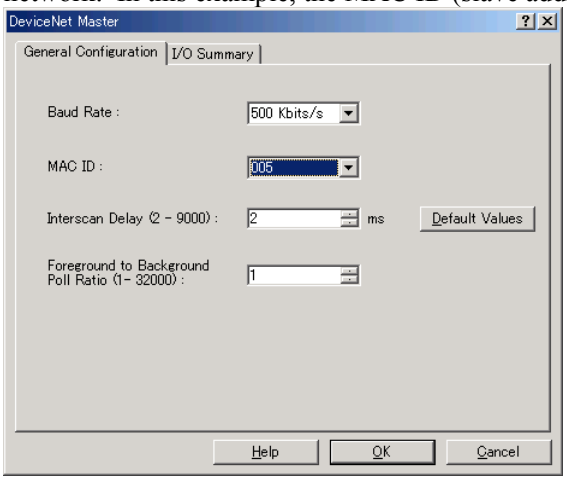
(1) Ensure that the board is connected to the fieldbus. Then, start the applicomIO console application.

(2) Click on the “Protocol list” under the board that was just added.



(3) Select **Protocol** | **Properties**.

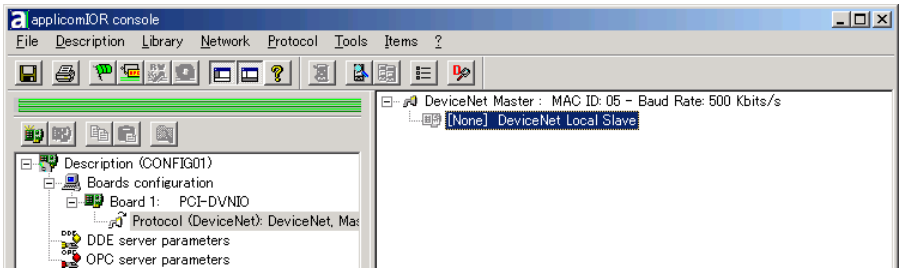
(4) Configure the baud rate, MAC ID (slave address), and so on for the DeviceNet network. In this example, the MAC ID (slave address) is set to 005.



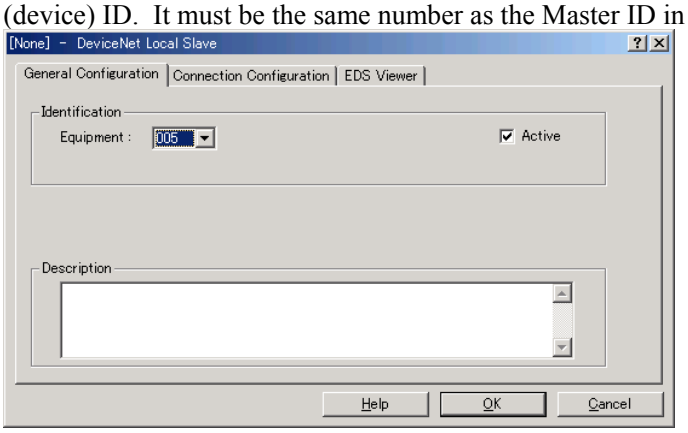
NOTE

Specify an unused address on the network for a slave device as well as other devices.

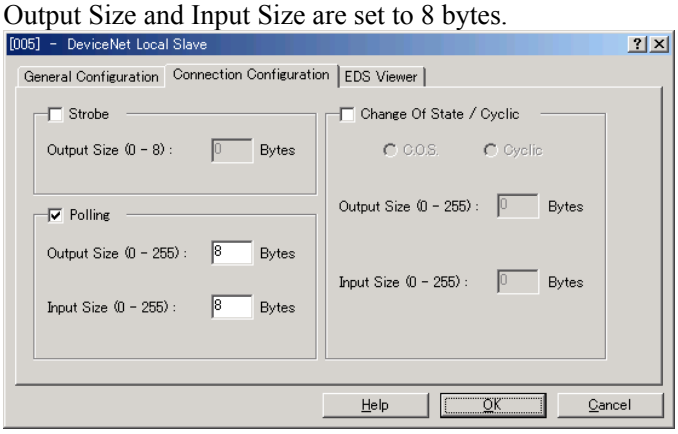
(5) Double-click the “DeviceNet Local Slave” item.



(6) The DeviceNet Local Slave property sheet will appear. Select the Equipment (device) ID. It must be the same number as the Master ID in step (4).



(7) Click on the **Connection Configuration** tab. Check the Polling check box and configure how many inputs and outputs for the slave device. In this example, the Output Size and Input Size are set to 8 bytes.



NOTE

The load on a bus varies depending on the input/output size settings.

When the load exceeds 60%, the DeviceNet network communications will be unstable, for example: more communication errors. Restrict the input/output sizes to the minimum necessary to minimize the load. The load is also controlled by baud rate in the master configuration.

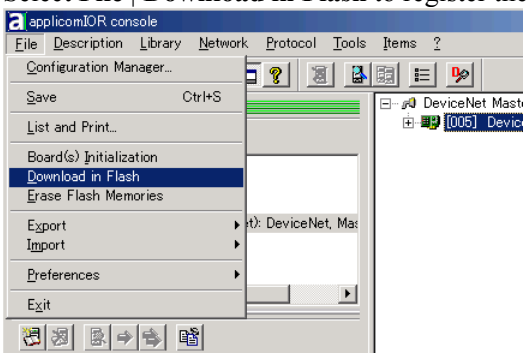
For the procedure for verifying the load on the bus using the applicomIO Console application, refer to the *4. Troubleshooting* in this manual.

The input/output sizes of each node may be restricted depending on the master.

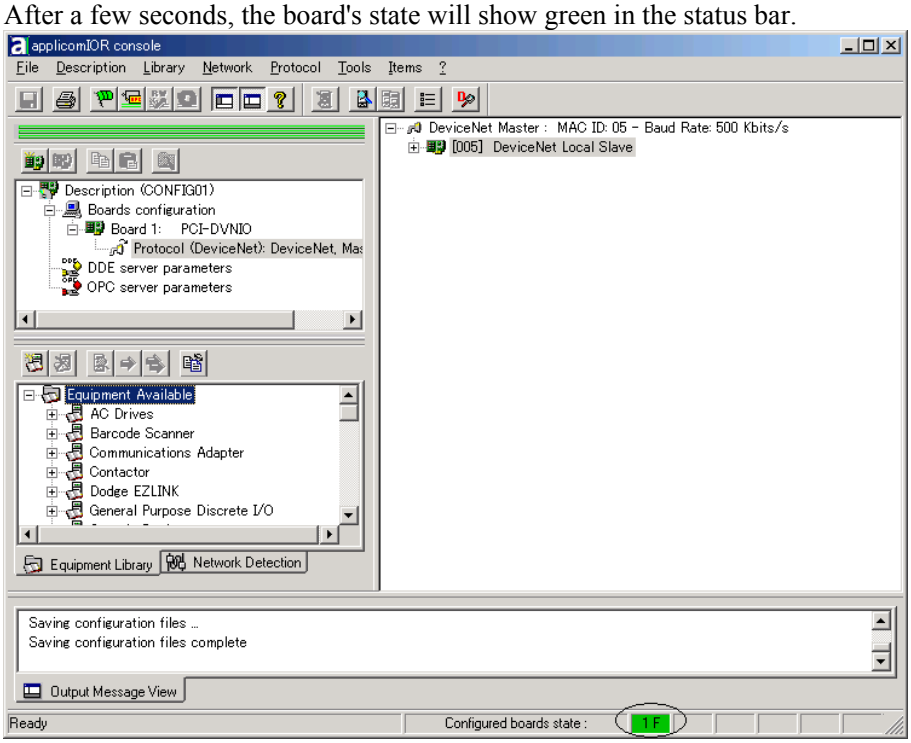
For details of the permitted data size, refer to the respective manuals of the masters.

(8) Click **OK**.

(9) Select **File** | **Download in Flash** to register the configuration in the fieldbus board.



After a few seconds, the board's state will show green in the status bar.



(10) Close the applicomIO console application.

(11) The default slave EDS file is created.
The path is: C:\Program Files\Woodhead\Direct-link\ApplicomIO2.3\ConfigIO\Config01\applicomio.eds.

You may make a copy of the default slave EDS file and modify it to create your original EDS file if necessary.

Edit the copy of the slave EDS file using Notepad. You may want to change the VendName and ProductTypeStr.

```
$  EDS File Generated by applicomIO® Console Version : 2.2

[File]
      DescText    = "EDS for applicomIO Scanner";
      CreateDate  = 02-01-2004;
      CreateTime  = 08:14:41;
      ModDate     = 02-01-2004;
      ModTime     = 08:14:41;
      Revision    = 1.0;

[Device]
      VendCode    = 579;
      ProdType    = 12;
      ProdCode    = 1;
      MajRev      = 1;
      MinRev      = 2;
      VendName    = "applicom international";
      ProdTypeStr = "Communication Adapter";
      ProdName    = "applicomIO Scanner";
      Catalog     = "";

[IO_Info]
      Default     = 0x0000;
```

Copy the EDS file to the system where the master is located. Add the new slave device to the master using the new EDS file.

(12) On the master system, scan the network for new devices. The new slave device should be detected.

Use the EDS file created in previous steps for the slave device.

2.8 PROFIBUS DP Board Installation

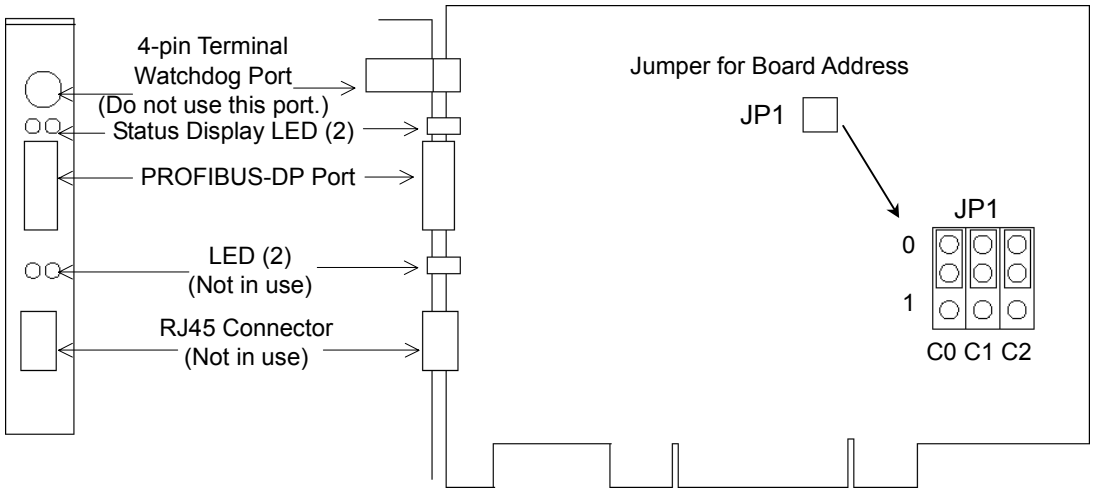
Following two board types can be used for the fieldbus I/O option PROFIBUS DP.

- PCU-DPIO
- PCI-DPIO

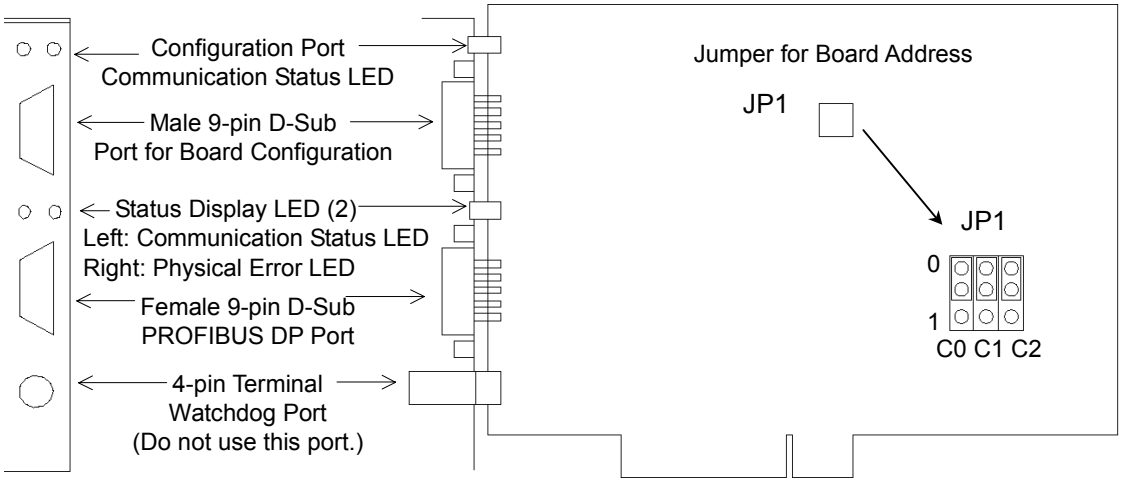
2.8.1 Board Appearance

Part names and functions of the scanner board are shown in the following figure. For details of the status display LEDs, refer to the *4. Troubleshooting* in this manual.

PCU-DPIO



PCI-DPIO



2.8.2 Specifications

Part Number	applicom PCI-DPIO / PCU-DPIO
Modes	Master/Slave
Baud Rates	9.6, 19.2, 93.75, 187.5, 500, 1500, 3000, 6000, 12000 kbps
Interface	1 PROFIBUS port (EN 50 170)
Output Current Capacity	Maximum 150mA
Supported Devices	All DP Devices
Maximum Stations	126 (32 per segment)
GDS Support	Yes
PROFIBUS DP Class 1	Yes
PROFIBUS DP Class 2	Yes
Input Data Size	1 to 244 bytes
Output Data Size	1 to 244 bytes
Automatic Detection	Yes. Devices can be detected automatically.

2.8.3 Software Installation

Before installing any boards in your controller, you must install the applicomIO console application and drivers for the type of board you will be using.

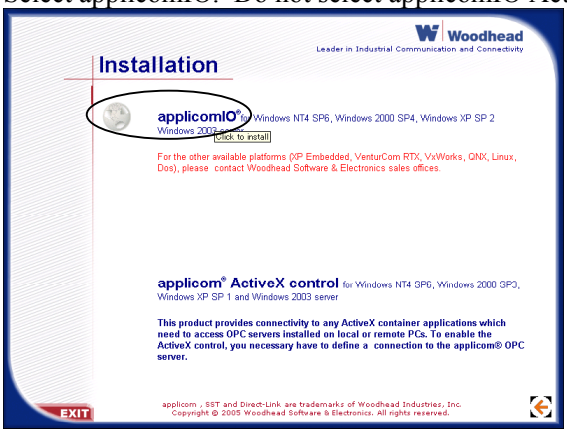
(1) Start the controller.

(2) Run the C:\Install\FieldBus\Install\applicomIO\Disk1\Setup.EXE from the install folder in the controller to start the installation.

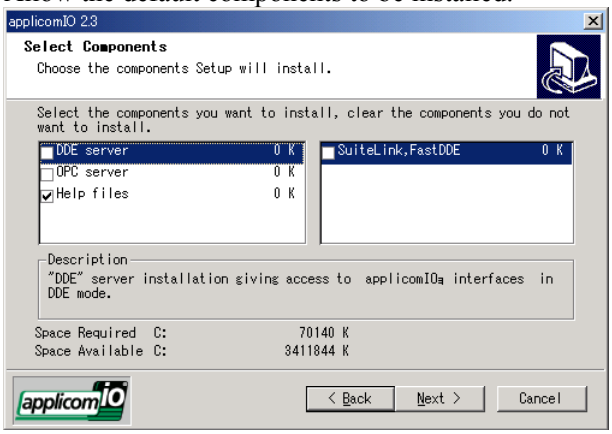
(3) Select the desired language for the installer.

(4) Select Install Products.

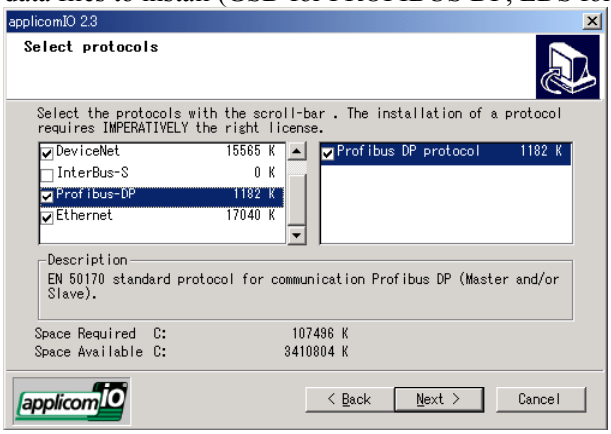
(5) Select applicomIO. Do not select applicomIO ActiveX.



(6) Allow the default components to be installed.



(7) Select the protocol: PROFIBUS DP you will be using.
If you also use DeviceNet, select DeviceNet as well. Select which type of device data files to install (GSD for PROFIBUS DP, EDS for DeviceNet).



(8) Complete the installation.

(9) The message to ensure the restart appears. Click the **Yes** button.

(10) Start the C:\Install\FieldBus\Install\SP\Setup.EXE and install the service pack. No installation is necessary when a service pack is not attached to controller.

(11) After completing the installation of the service pack, shutdown the computer.

(12) Proceed to *2.6.4 Board Installation.*

2.8.4 Board Installation

WARNING	■ Make sure that the power is turned OFF before installing/removing any boards or connecting/disconnecting any cables. Installing/removing any boards or connecting/disconnecting any cables with the power ON is extremely hazardous and may result in electric shock and/or malfunction of equipment.

(1) Configure the board address jumper (JP1) on each board. The board number must start with 1 consecutively. Refer to the following table for JP1 configuration.

Short Socket / Board No.	C0	C1	C2
1	0: Short	0: Short	0: Short
2	1: Short	0: Short	0: Short
3	0: Short	1: Short	0: Short
4	1: Short	1: Short	0: Short
5	0: Short	0: Short	1: Short
6	1: Short	0: Short	1: Short
7	0: Short	1: Short	1: Short
8	1: Short	1: Short	1: Short

(2) Install the board(s) in any available PCI slot in the controller.

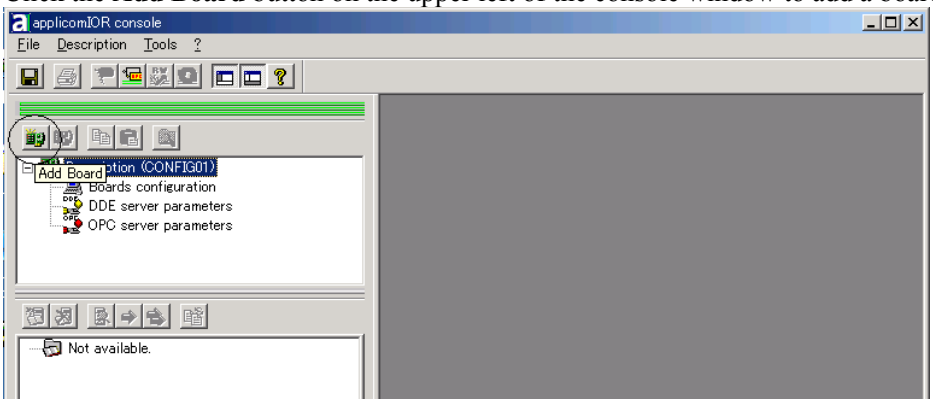
(3) Connect the board(s) to the Fieldbus.

(4) Start the controller.

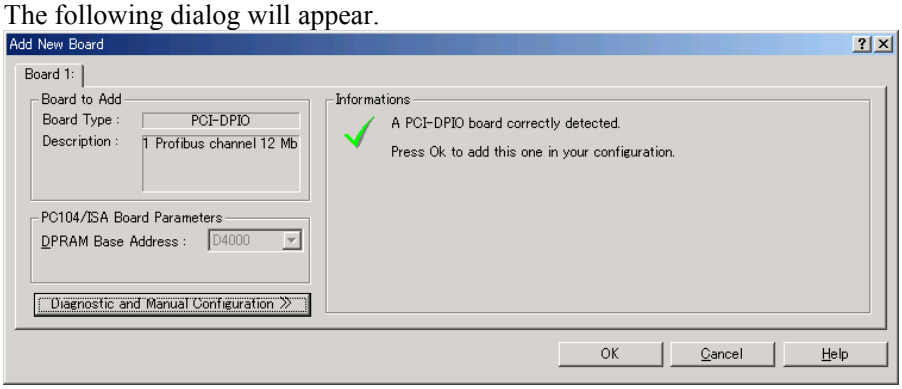
(5) The Windows Hardware Wizard will display a message that the applicomIO board was found and prompt you to restart the computer.
The applicomIO console application will automatically start for this first start after installation. Close this application for now and restart the controller.

(6) Start the applicomIO console application.

(7) Click the **Add Board** button on the upper left of the console window to add a board.

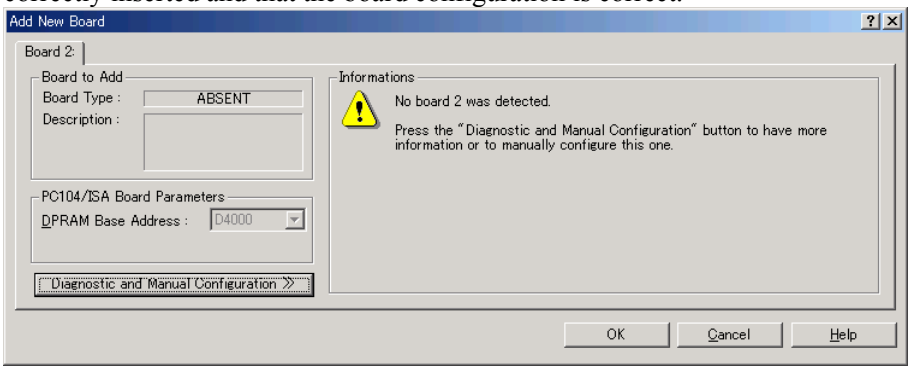


(8) The following dialog will appear.



Check that "PCI-DPIO" or "PCU-DPIO" ("PCI-DVNIO" in case of DeviceNet) is shown in the **Board Type:** box. Then, click the **OK** button.
When installing more than two fieldbus boards in the system, add all the boards using this dialog.

The following dialog will appear when no board is detected. Ensure that the board is correctly inserted and that the board configuration is correct.



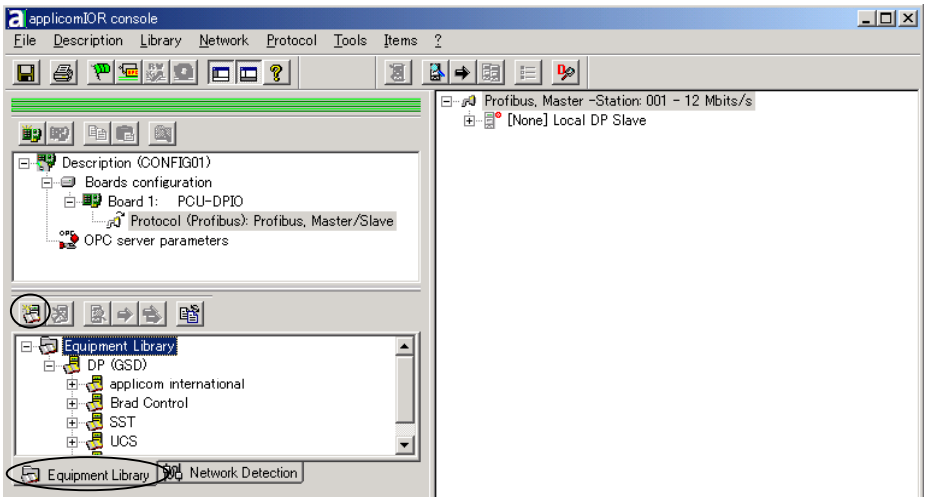
(9) After all the boards are added, the system should be restarted.
Close the applicomIO Console application and click the **OK** button on the **Save modification** dialog. Click the **OK** button on the following dialog to restart Windows.

(10) After restarting the system, continue with the following *2.6.5 Master Mode* or *2.6.6 Slave Mode* sections.

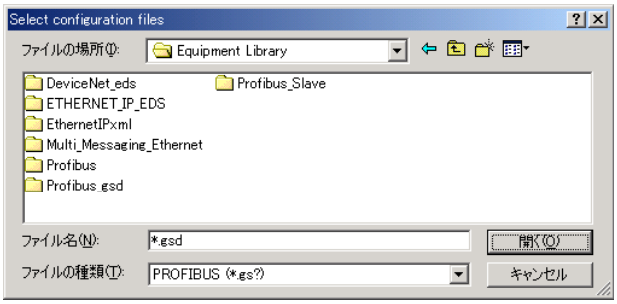
2.8.5 Master Mode

(1) Ensure that the board is connected to the fieldbus. Then, start the applicomIO console application.

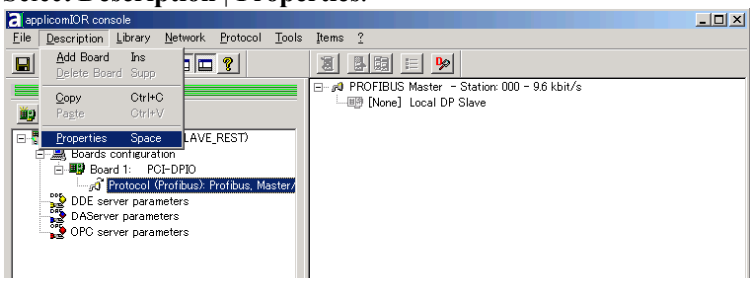
(2) Register the device information (GSD file) that is necessary for the network setup. Select the [Equipment Library] tab at the center of the dialog's right side and click the **Add** icon.



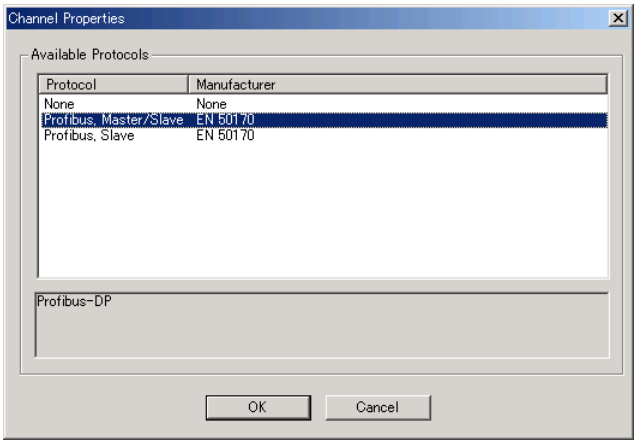
(3) Following dialog appears. Specify the GSD file that is supplied from the device manufacturer.



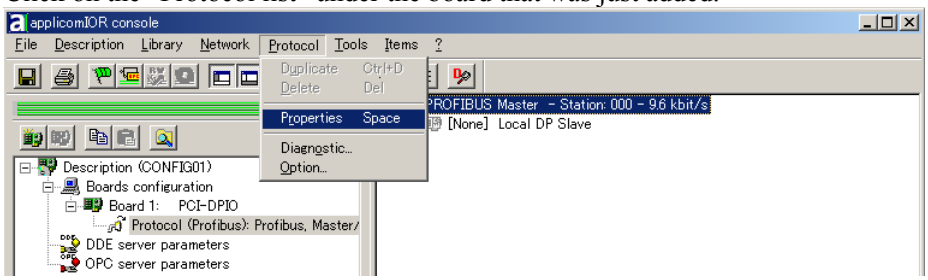
(4) Select **Description** | **Properties**.



(5) Select the “Profibus, Master/Slave” in the **Channel Properties** dialog and click the **OK** button.

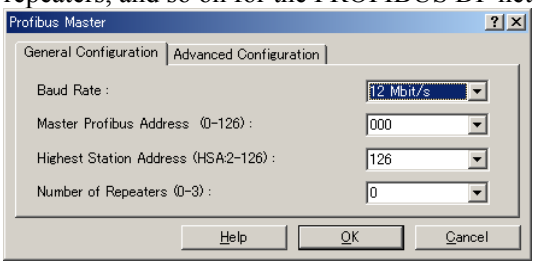


(6) Click on the “Protocol list” under the board that was just added.

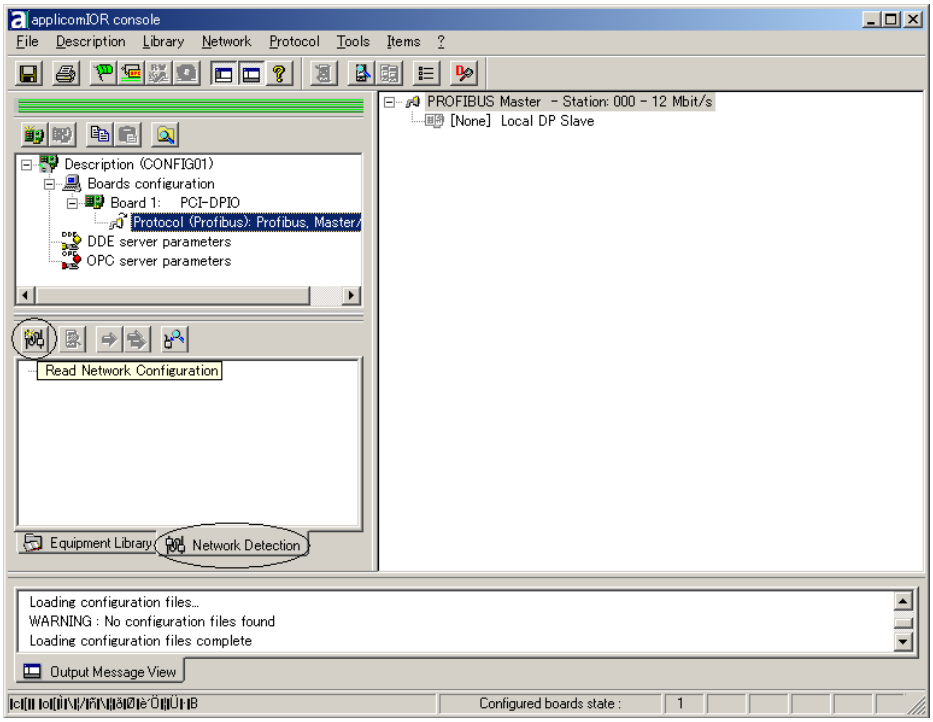


(7) Select **Protocol** | **Properties**.

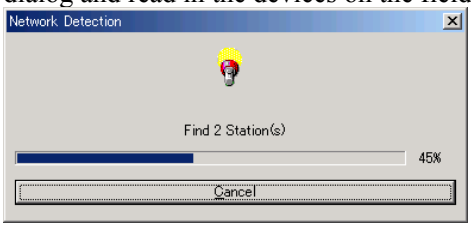
(8) Configure the baud rate, Master Profibus Address (master address), number of repeaters, and so on for the PROFIBUS DP network.



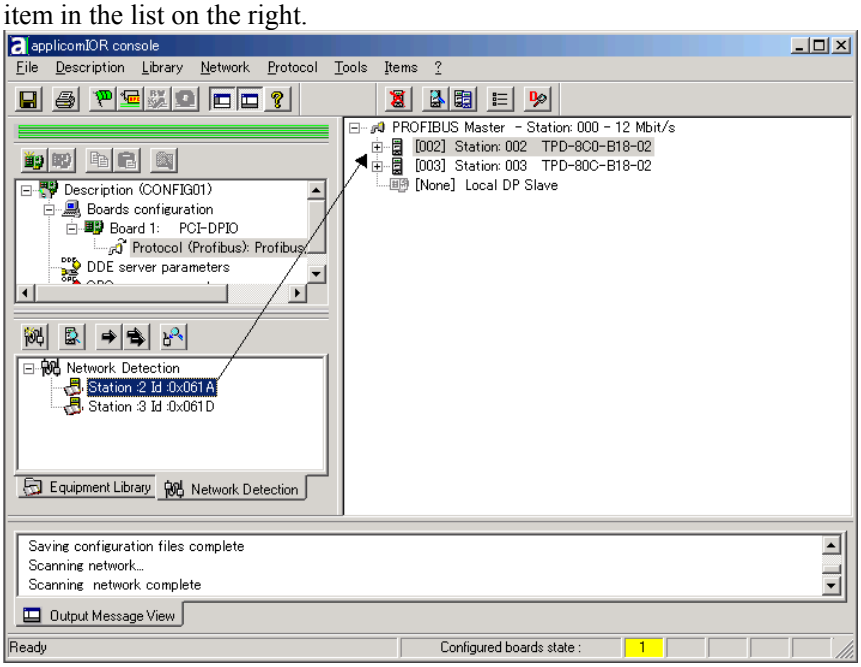
(9) Click the **Network Detection** tab on the center left of the console window.



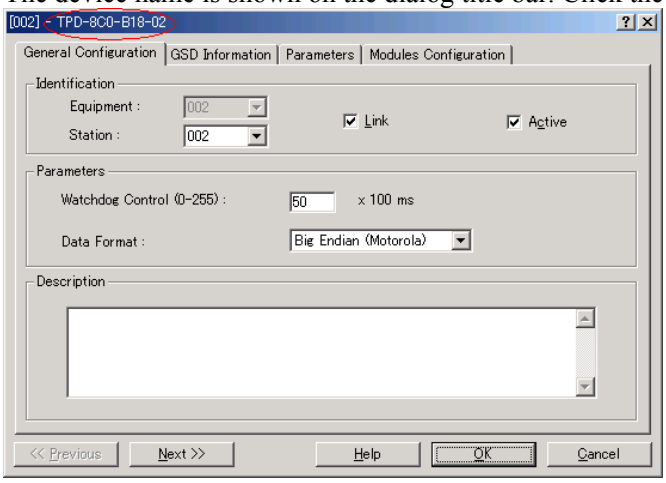
(10) Click the **Read Network Configuration** button to display the **Network Detection** dialog and read in the devices on the fieldbus.



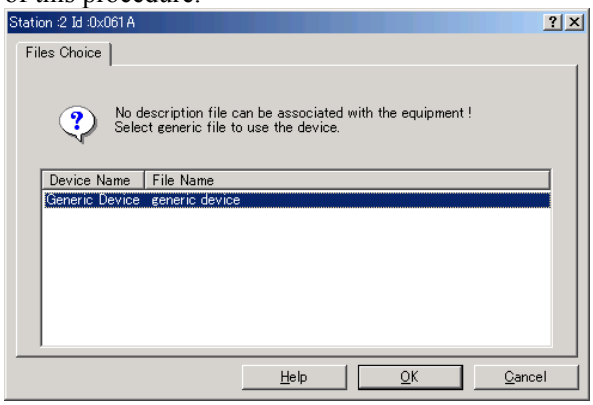
(11) Drag each device you want to scan from the **Network Detection** tab to the Master item in the list on the right.

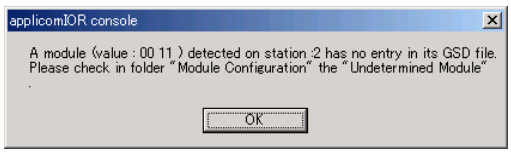


(12) The following dialog will appear.
The device name is shown on the dialog title bar. Click the **OK** button.

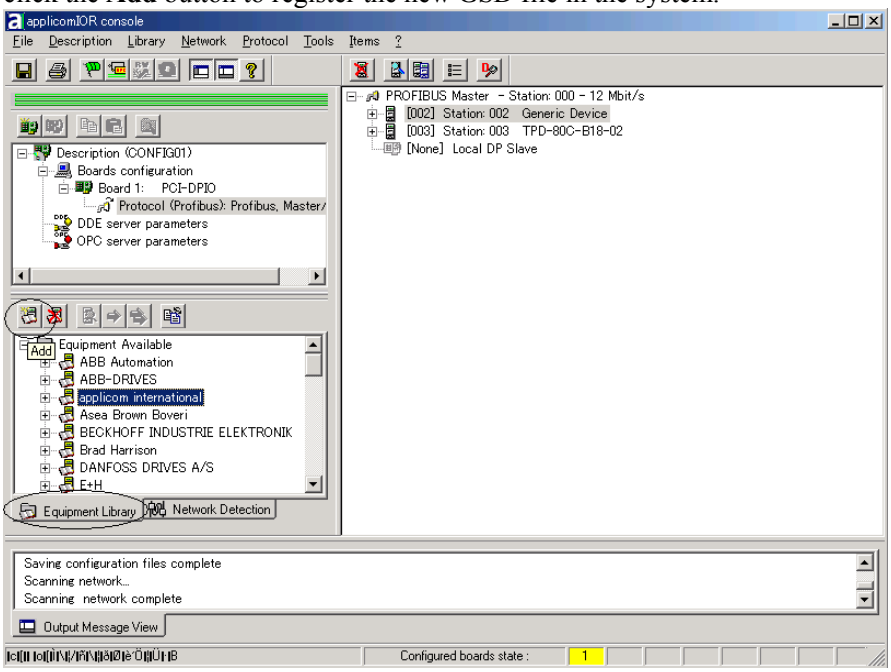


When the system cannot identify the device you want to use (its GSD file is not registered), the following dialog will appear. In this case, obtain the GSD file from the device manufacturer and register it. Then, start from step 5 (Network Detection) of this procedure.

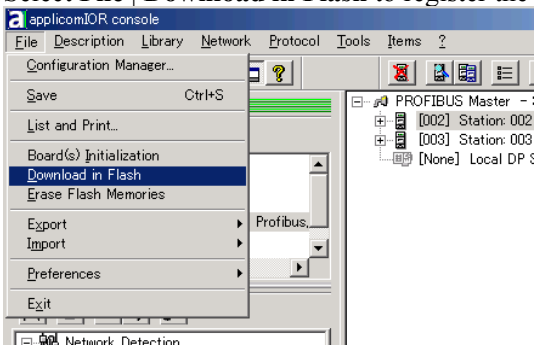




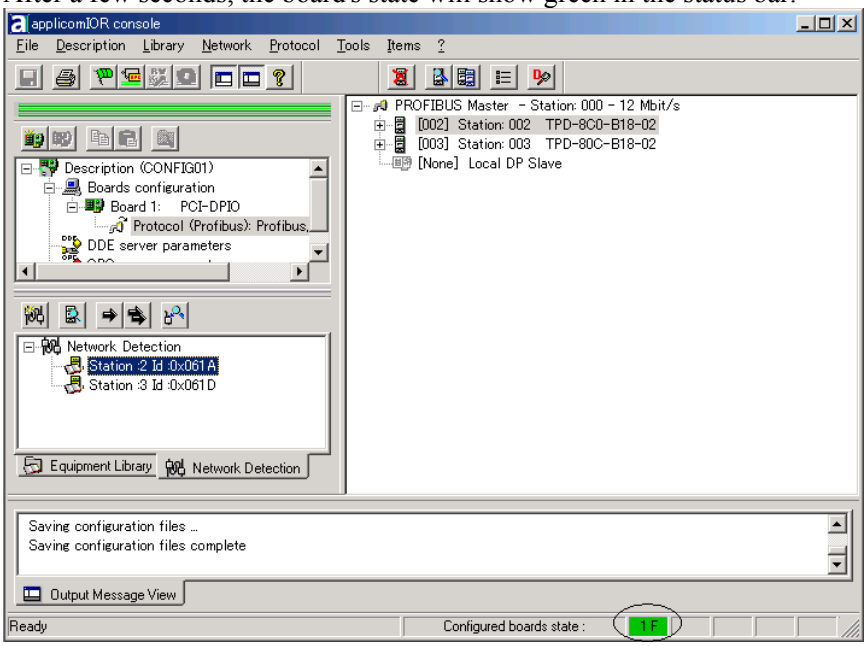
(13) Select the **Equipment Library** tab on the center left of the console window and click the **Add** button to register the new GSD file in the system.



(14) Select **File** | **Download in Flash** to register the configuration in the fieldbus board.



After a few seconds, the board's state will show green in the status bar.

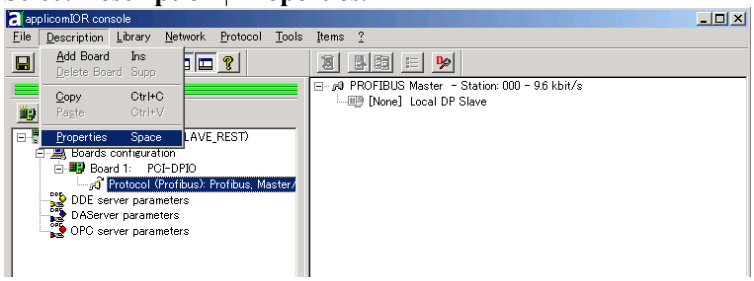


Now, the fieldbus board is ready to operate as a master. Close the applicomIO Console application.

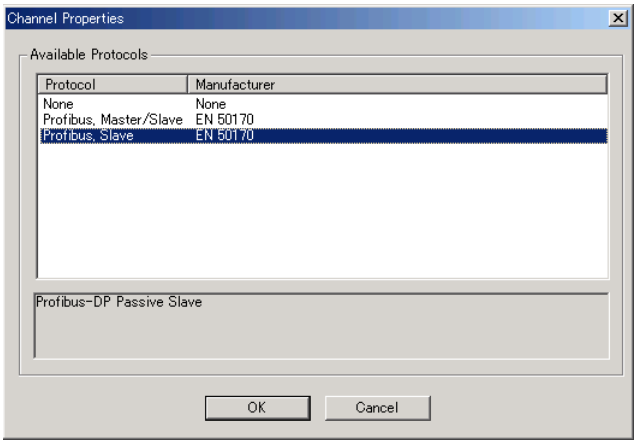
2.8.6 Slave Mode

(1) Ensure that the board is connected to the fieldbus. Then, start the applicomIO console application.

(2) Select **Description** | **Properties**.



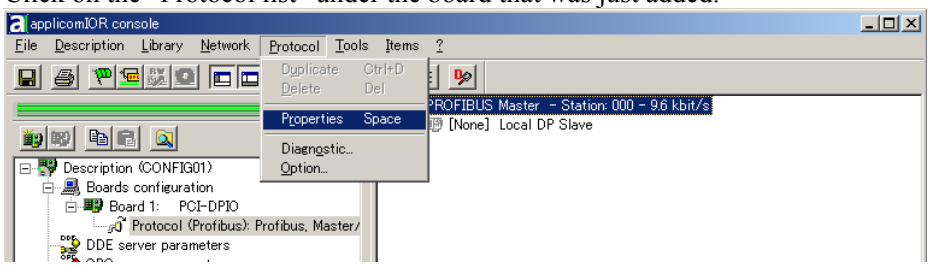
(3) Select the "Profibus, Slave" in the **Cannel Properties** dialog and click the **OK** button.



NOTE

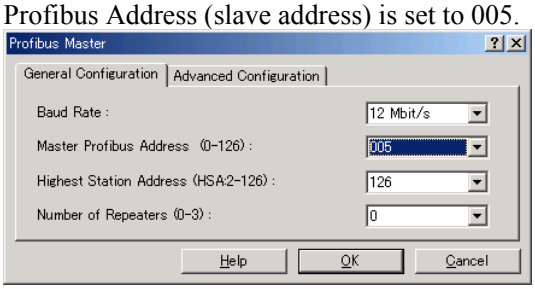
Though you can select the "Profibus, Master/Slave" as a slave, it might not communicate properly in some Master.
To use only the slave function, select the "Profibus, Slave".

(4) Click on the "Protocol list" under the board that was just added.



(5) Select **Protocol** | **Properties**.

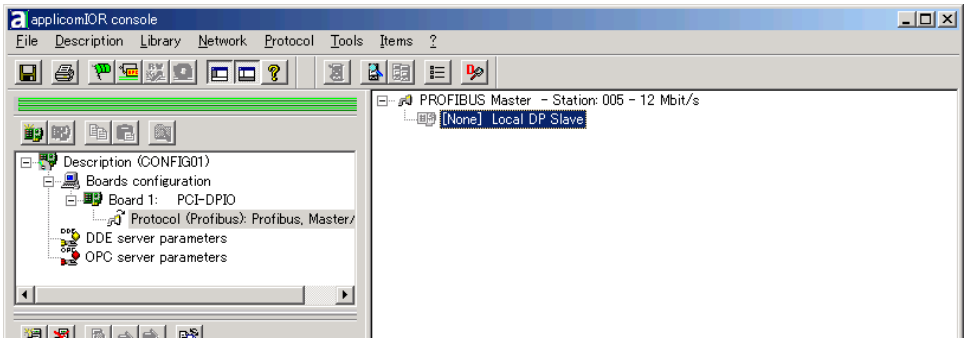
(6) Configure the baud rate, Master Profibus Address (slave address), number of repeaters, and so on for the PROFIBUS DP network. In this example, the Master Profibus Address (slave address) is set to 005.



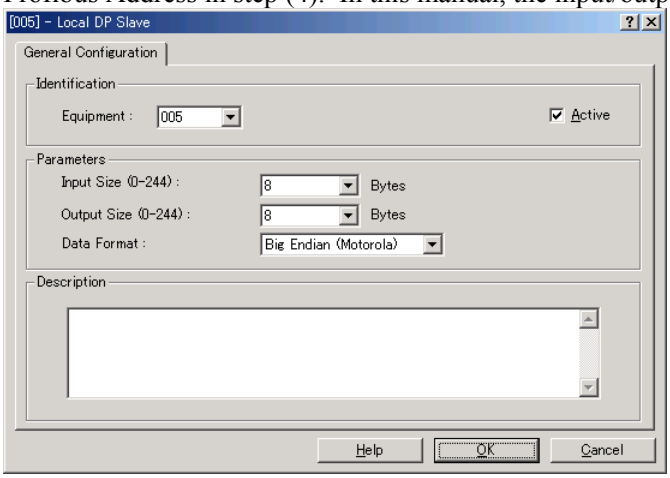
NOTE

Specify an unused address on the network for a slave device as well as other devices.

(7) Double-click the "Local DP Slave" item.



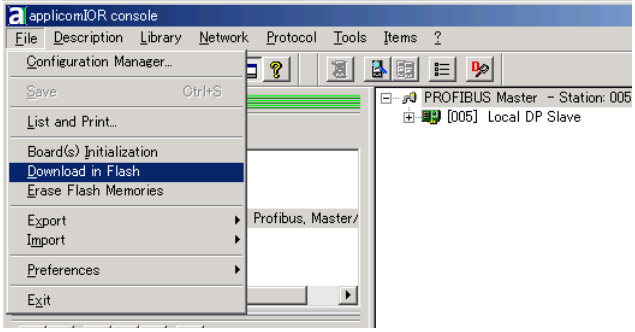
(8) The Local DP Slave property sheet will appear.
Select the Equipment (device) ID. It must be the same number as the Master Profibus Address in step (4). In this manual, the input/output sizes are set to 8 bytes.



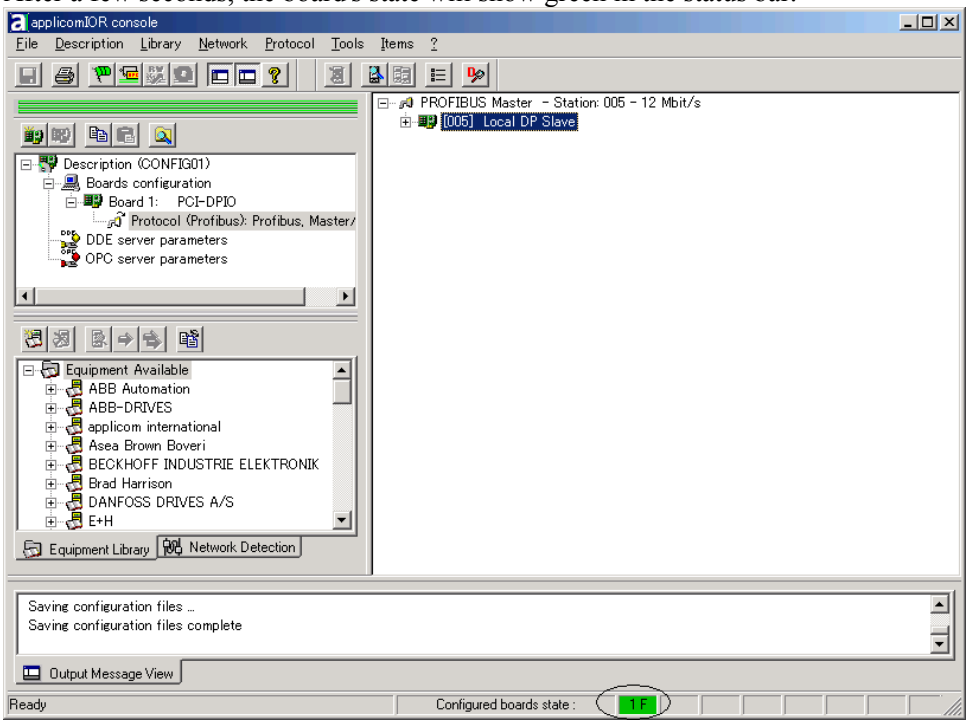
NOTE

The input/output sizes of each station may be restricted depending on the master. For details of the permitted data size, refer to the respective manuals of the masters.

(9) Select **File** | **Download in Flash** to register the configuration in the fieldbus board.



After a few seconds, the board's state will show green in the status bar.



(10) Now the fieldbus board is ready to operate as a slave. Close the applicomIO Console application.

2.8.7 GSD File

A GSD file is a device data file for registering slave configuration data in the configurator (device or software that configures the master).

The standard GSD file for EPSON robot controller RC520 and RC420 is provided in the following path:

c:\Program Files\Woodhead\Direct-Link\applicomIO2.3\Equipment Library \Profibus_gsd\app0890.gsd.

For details of the PROFIBUS DP network configuration, contact the manufacturer of the master device you use. If you use EPSON RC+ as a master device, you do not need to register EPSON RC+ since the said GSD file was installed.

2.9 EtherNet/IP Board Installation

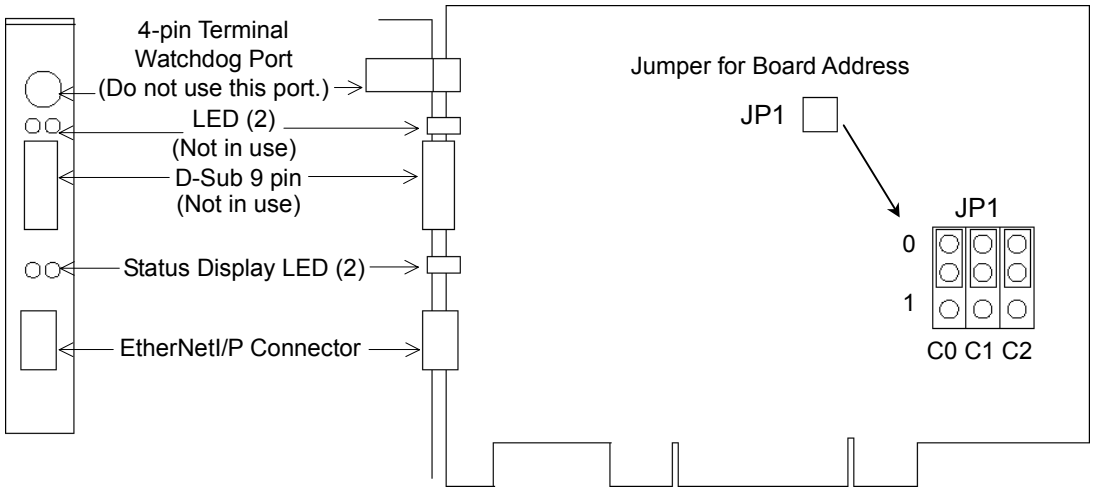
Following two board types can be used for the fieldbus I/O option EtherNet/IP.

- PCU-ETHIO

2.9.1 Board Appearance

Part names and functions of the scanner board are shown in the following figure. For details of the status display LEDs, refer to the *4. Troubleshooting* in this manual.

PCU-ETHIO



2.9.2 Specifications

Part Number	applicom PCU-ETHIO
Modes	Master/Slave
Baud Rates	10, 100 Mbps
Interface	EtherNet/IP 1 port
Maximum Node	127
Connection Type	Cyclic, Change of State
Explicit messaging	Yes
EDS support	Yes
Input Data Size	1 to 505 bytes
Output Data Size	1 to 509 bytes
Automatic Detection	Yes. Devices can be detected automatically.

2.9.3 Software Installation

Before installing any boards in your controller, you must install the applicomIO console application and drivers for the type of board you will be using.

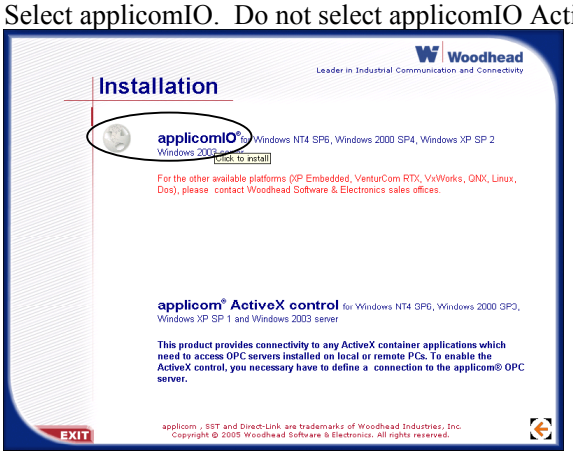
(1) Start the controller.

(2) Run the C:\Install\FieldBus\Install\applicomIO\Disk1\Setup.EXE from the install folder in the controller to start the installation.

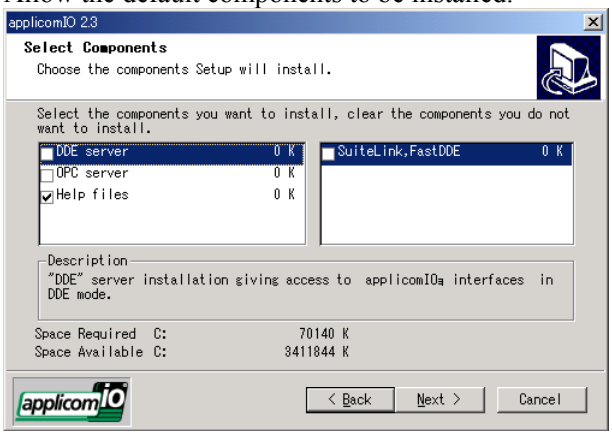
(3) Select the desired language for the installer.

(4) Select Install Products.

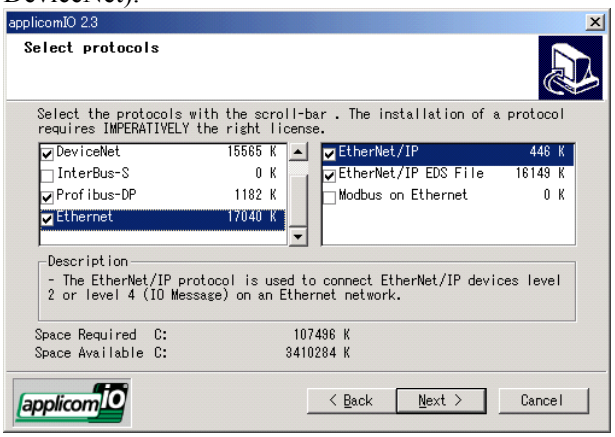
(5) Select applicomIO. Do not select applicomIO ActiveX.



(6) Allow the default components to be installed.



(7) Select the protocol: Ethernet you will be using.
If you also use DeviceNet, select DeviceNet as well. If you also use PROFIBUS DP, select Profibus-DP as well.
Select which type of device data files to install (GSD for PROFIBUS DP, EDS for DeviceNet).



(8) Complete the installation.

(9) The message to ensure the restart appears. Click the **Yes** button.

(10) Start the C:\Install\FieldBus\Install\SP\Setup.EXE and install the service pack.
No installation is necessary when a service pack is not attached to controller.

(11) After completing the installation of the service pack, shutdown the computer.

(12) Proceed to *2.9.4 Board Installation.*

2.9.4 Board Installation

WARNING	■ Make sure that the power is turned OFF before installing/removing any boards or connecting/disconnecting any cables. Installing/removing any boards or connecting/disconnecting any cables with the power ON is extremely hazardous and may result in electric shock and/or malfunction of equipment.

(1) Configure the board address jumper (JP1) on each board. The board number must start with 1 consecutively. Refer to the following table for JP1 configuration.

Short Socket / Board No.	C0	C1	C2
1	0: Short	0: Short	0: Short
2	1: Short	0: Short	0: Short
3	0: Short	1: Short	0: Short
4	1: Short	1: Short	0: Short
5	0: Short	0: Short	1: Short
6	1: Short	0: Short	1: Short
7	0: Short	1: Short	1: Short
8	1: Short	1: Short	1: Short

(2) Install the board(s) in any available PCI slot in the controller.

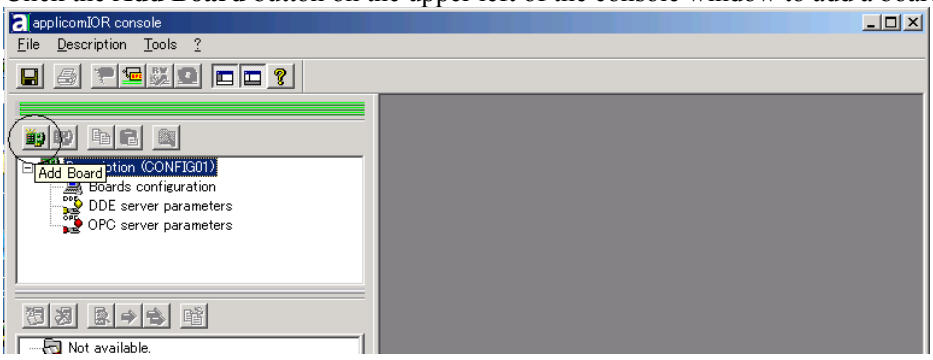
(3) Connect the board(s) to the Fieldbus.

(4) Start the controller.

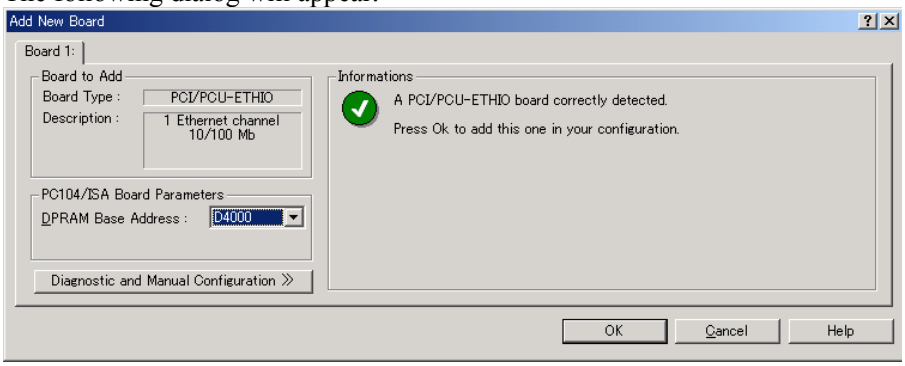
(5) The Windows Hardware Wizard will display a message that the applicomIO board was found and prompt you to restart the computer.
The applicomIO console application will automatically start for this first start after installation. Close this application for now and restart the controller.

(6) Start the applicomIO console application.

(7) Click the **Add Board** button on the upper left of the console window to add a board.

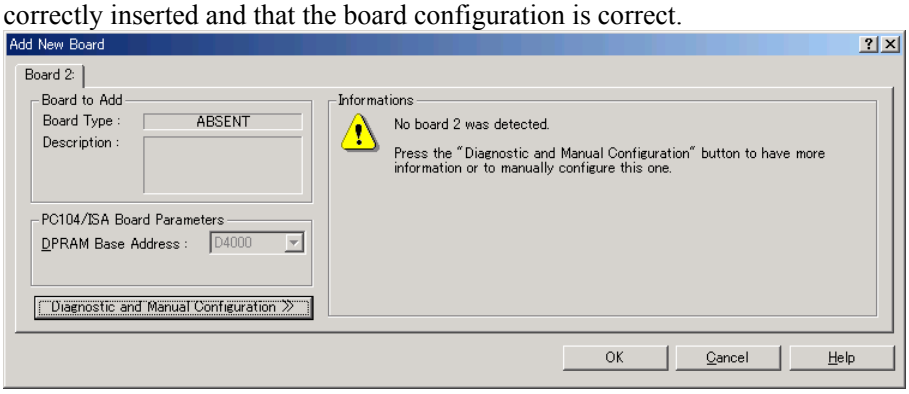


(8) The following dialog will appear.

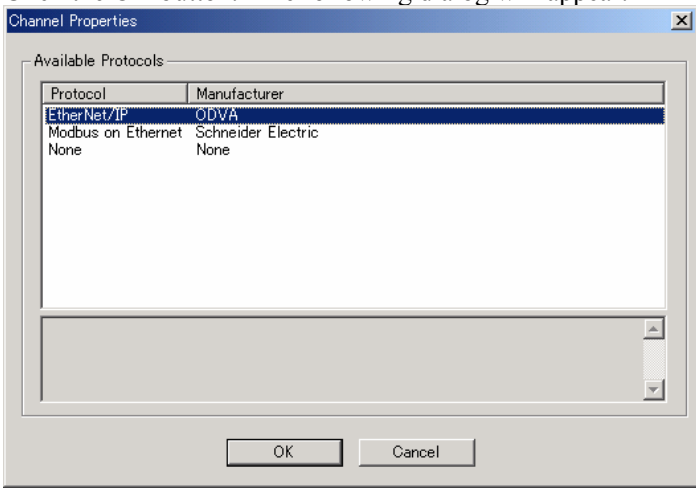


Check that "PCI/PCU-ETHIO ("PCI-DVNIO" in case of DeviceNet, and ""PCI-DPIO" or "PCU-DPIO" in case of PROFIBUS-DP) is shown in the **Board Type:** box. Then, click the **OK** button.
When installing more than two fieldbus boards in the system, add all the boards using this dialog.

The following dialog will appear when no board is detected. Ensure that the board is correctly inserted and that the board configuration is correct.

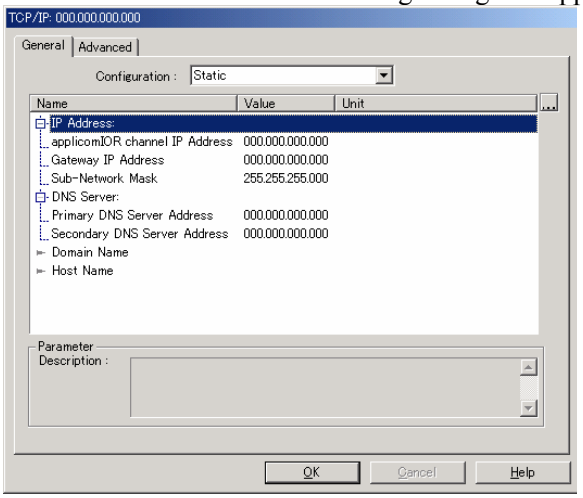


(9) Click the OK button. The following dialog will appear.

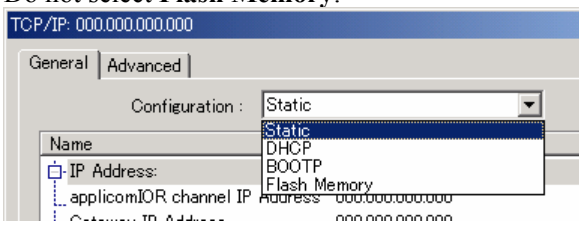


Select **EtherNet/IP** from Protocol, and click the OK button.

(10) Click the OK button. The following dialog will appear.



Configure the IP address for the EtherNet/IP board.
Select the IP address from Static, DHCP, or BOOTP at **Configuration**.
Do not select **Flash Memory**.



When you select **Static**, set the values for each item.

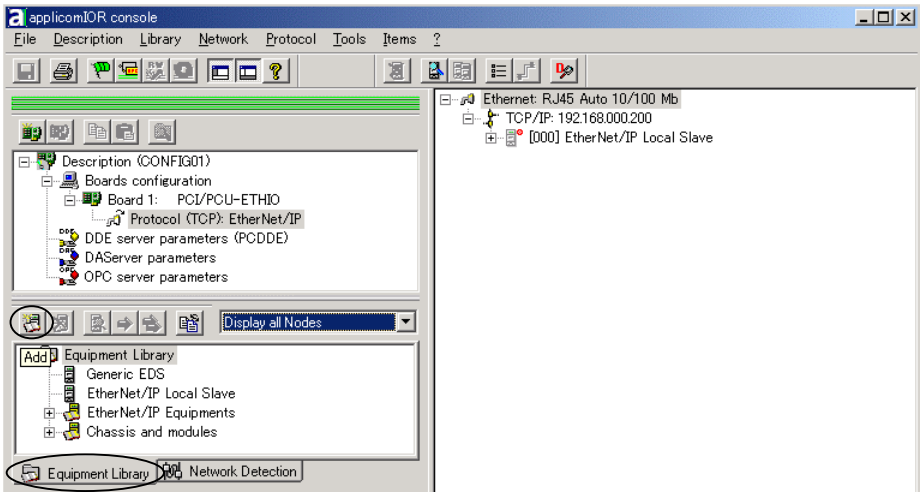
(11) After all the boards are added, the system should be restarted.
Close the applicomIO Console application and click the **OK** button on the **Save modification** dialog. Click the **OK** button on the following dialog to restart Windows.

(12) After restarting the system, continue with the following *2.9.5 Master Mode* or *2.9.6 Slave Mode* sections.

2.9.5 Master Mode

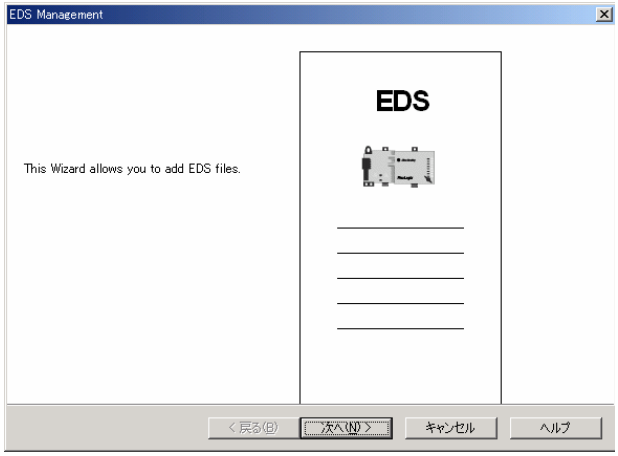
(1) Ensure that the board is connected to the fieldbus. Then, start the applicomIO console application.

(2) Register the device information (EDS file) that is necessary for the network setup. Select the [Equipment Library] tab at the center of the dialog's right side and click the **Add** icon.

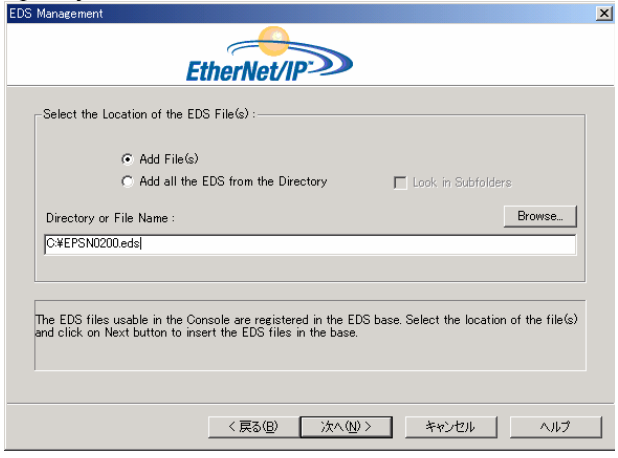


(3) Following dialog appears. Register the EDS file that is supplied from the device manufacturer.

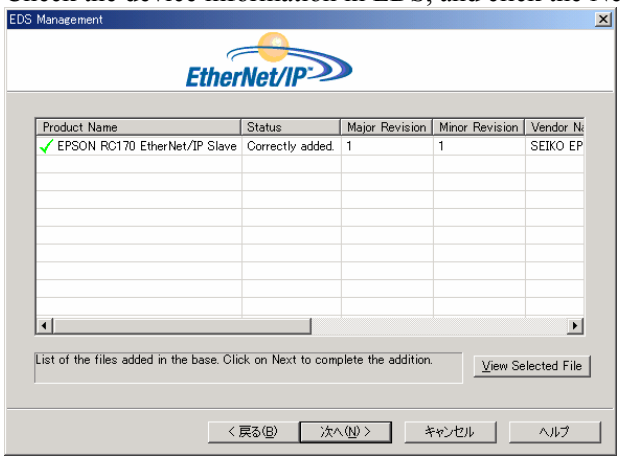
(3)-1 Click Next button.



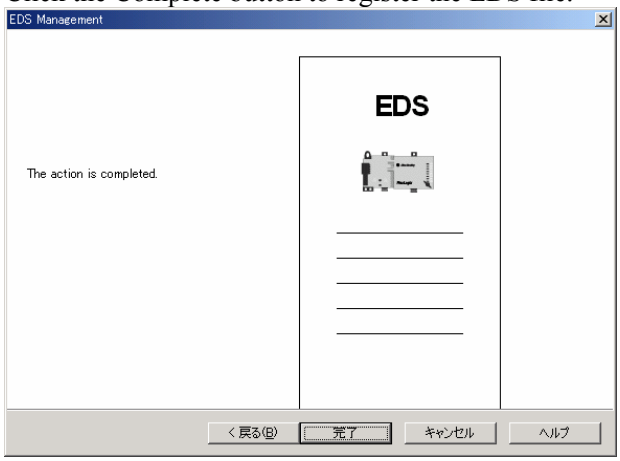
(3)-2 Specify the folder that EDS is stored, and click the Next button.



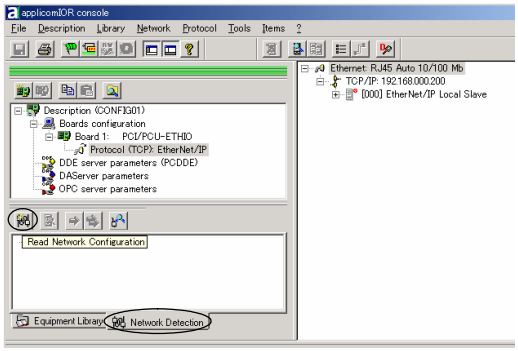
(3)-3 Check the device information in EDS, and click the Next button.



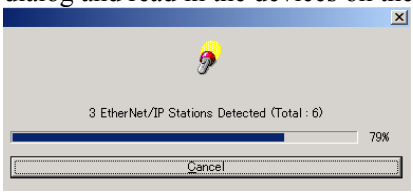
(3)-4 Click the Complete button to register the EDS file.



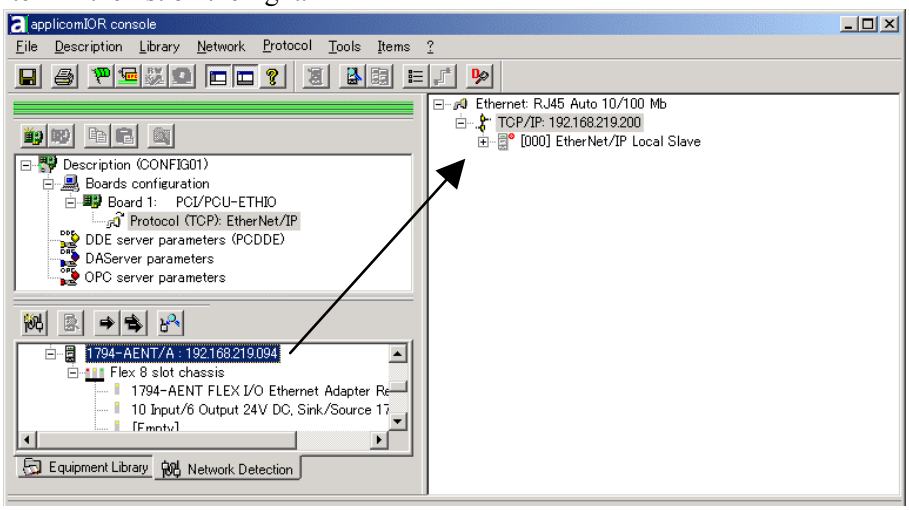
(4) Click the Network Detection tab on the center left of the console window.



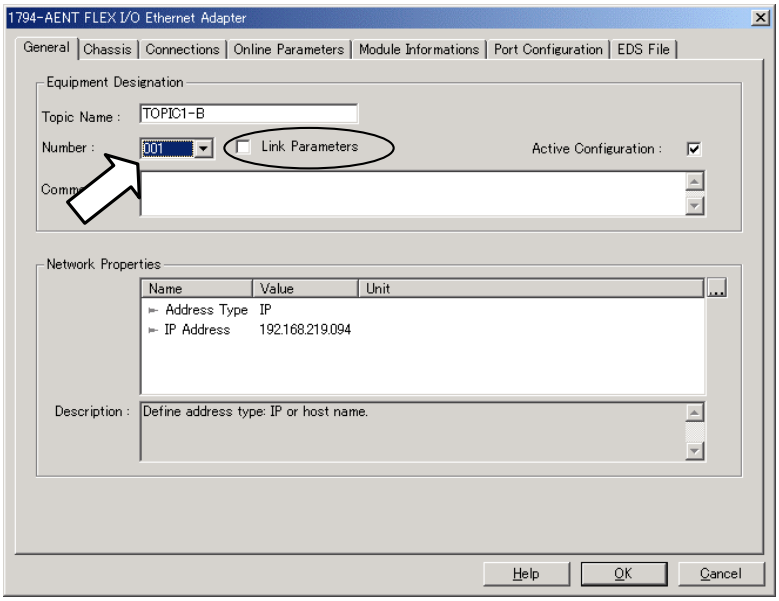
(5) Click the Read Network Configuration button to display the Network Detection dialog and read in the devices on the fieldbus.



(6) Drag each device you want to scan from the Network Detection tab to the Master item in the list on the right.

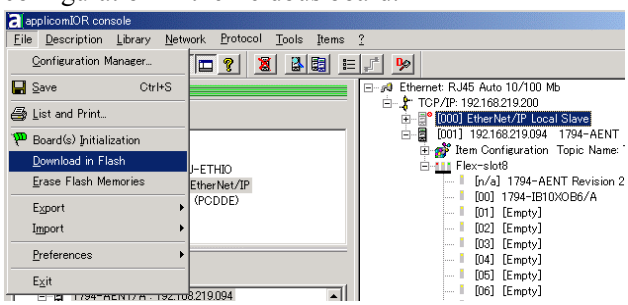


(7) Following dialog appears.

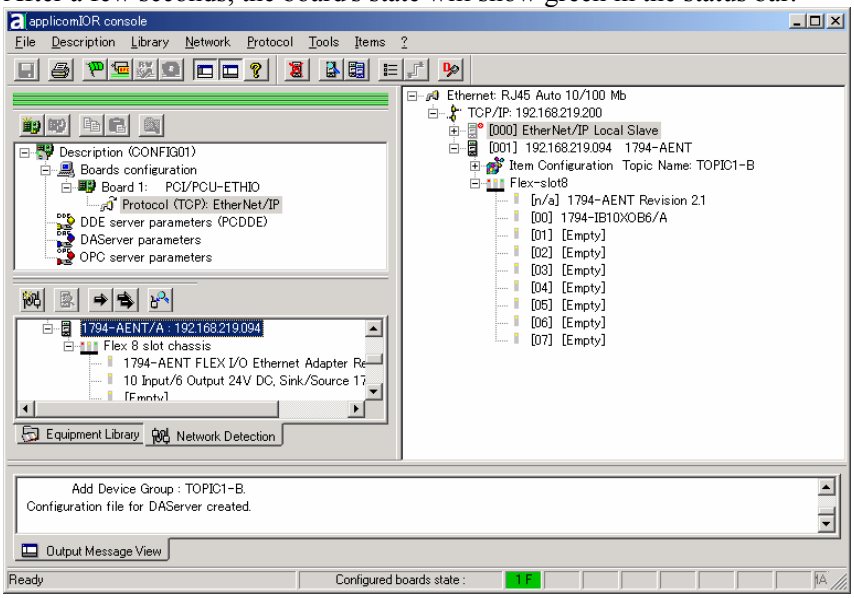


Uncheck the Link Parameter box and assign a value from 1 to 127. This number is called as device ID and necessary to create SPEL+ programs.
Click the OK button to complete the registration.

(8) After finishing devices registration, select File | Download in Flash to register the configuration in the fieldbus board.



After a few seconds, the board's state will show green in the status bar.

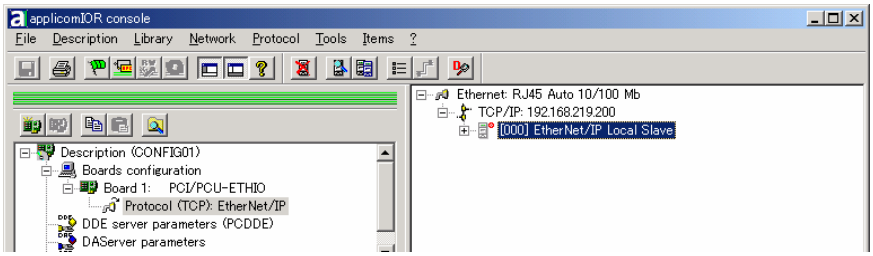


Now, the fieldbus board is ready to operate as a master. Close the applicomIO Console application.

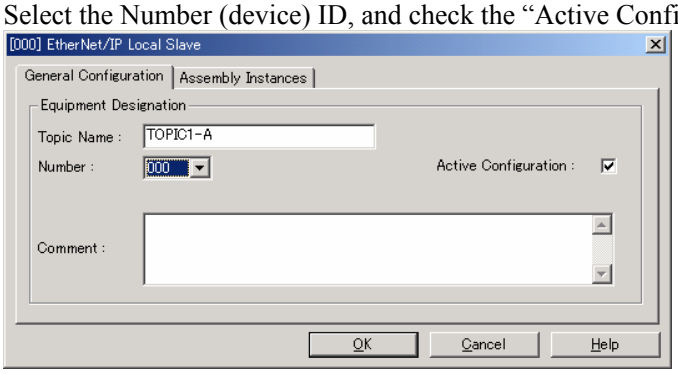
2.9.6 Slave Mode

(1) Ensure that the board is connected to the fieldbus. Then, start the applicomIO console application.

(2) Double-click the “EtherNet/IP Local Slave” item.



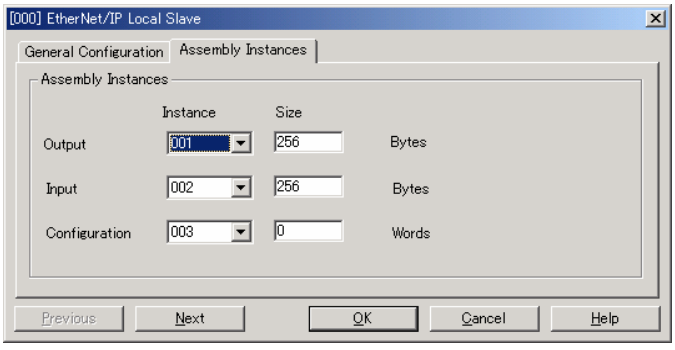
(3) The EtherNet/IP Local Slave property sheet will appear.
Select the Number (device) ID, and check the “Active Configuration”.



(4) Click on the **Assembly Instance** tab. Configure how many inputs and outputs for the slave device. In this example, the Sizes and Instances of Input and Output are set as follows.

[Output]-[Instance] : 001
[Output]-[Size] : 256 (bytes)
[Input]-[Instance] : 002
[Input]-[Size] : 256 (bytes)

Value of Configuration | Size is not available for EPSON RC+. Set “0” (Words) for this box.

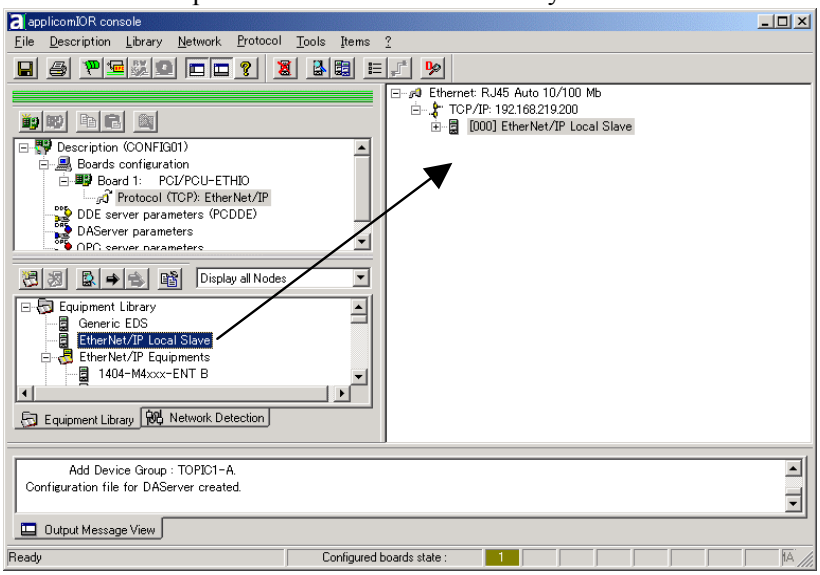


NOTE

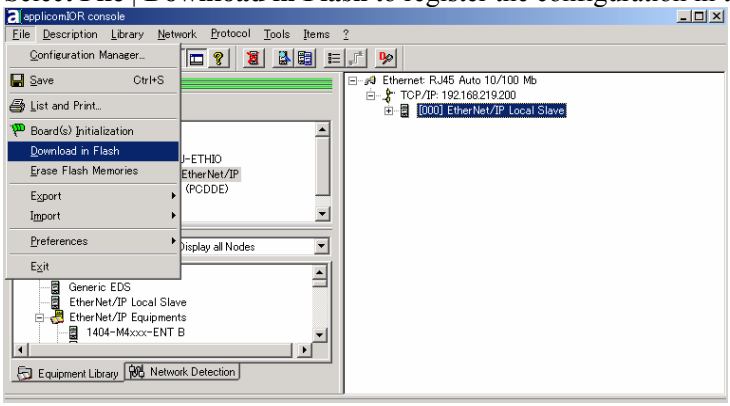
Make sure that the input/output size settings do not exceed 14 kbytes in total.
The input/output sizes of each node may be restricted depending on the master.
For details of the permitted data size, refer to the respective manuals of the masters.

(5) Click **OK**.

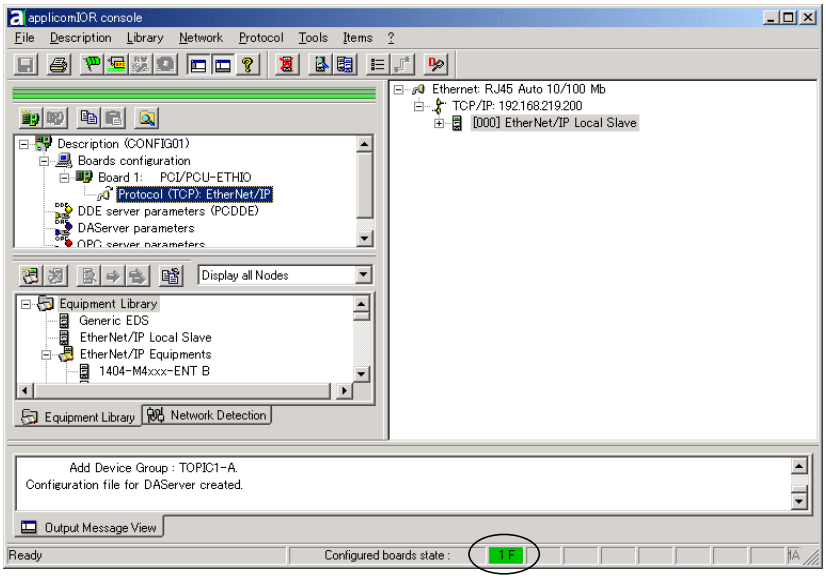
(6) Drag **EtherNet/IP Local Slave** from **Equipment Library** to the Master item in the list on the right.
Window in step 5 appears. Configure by the procedures from step 7.
You can create up to 32 Local Slaves if necessary.



(7) Select **File** | **Download in Flash** to register the configuration in the fieldbus board.



After a few seconds, the board's state will show green in the status bar.



(8) Close the applicomIO console application.

(9) The default slave EDS file is created.
The path is: C:\Program Files\Woodhead\Direct-link\ApplicomIO2.3\ConfigIO \Config01\applicomio.eds.

You may make a copy of the default slave EDS file and modify it to create your original EDS file if necessary.

Edit the copy of the slave EDS file using Notepad. You may want to change the VendName and ProductTypeStr.

Copy the EDS file to the system where the master is located. Add the new slave device to the master using the new EDS file.

(10) On the master system, scan the network for new devices. The new slave device should be detected.

Use the EDS file created in previous steps for the slave device.

2.10 EPSON RC+ Fieldbus I/O Installation

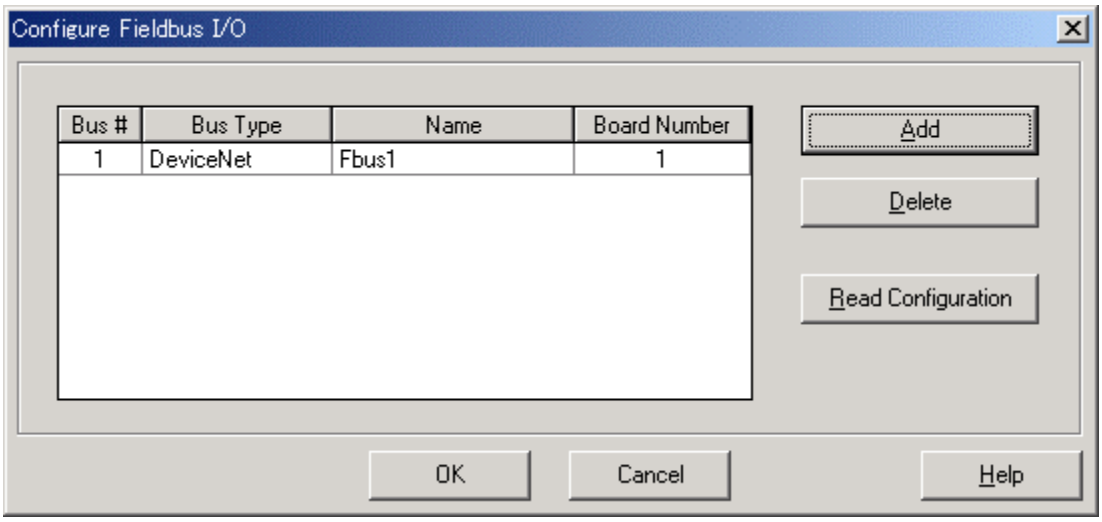
After you have created your fieldbus network and installed the scanner board(s) in your controller, you must configure the EPSON RC+ Fieldbus I/O option.

> Before continuing, the fieldbus scanner boards must have the device configuration stored in the board's flash memory, as described in the chapter *Installation*. Otherwise, the fieldbus boards will function improperly and EPSON RC+ cannot control them.
>
> See the *2. Installation* to store the device configuration in the flash memory.

Fieldbus I/O Software Configuration

To configure Fieldbus I/O, select System Configuration from the Setup menu. Click the I/O Systems tab, then select Fieldbus I/O from the list and click the Configure button. The dialog shown below will be displayed.

Set the bus type, name, and board type properly and click the **Read Configuration** button.



Option	Description
Add	Click this button to add a Fieldbus.
Delete	Click this button to delete the last Fieldbus. It will be dimmed when the last Fieldbus is not selected or there are no Fieldbuses installed.
Bus Type	Click in the Bus Type field and click the arrow on the right side of the field to select the Fieldbus type.
Board Number	The Board Number field is automatically incremented. The boards must be configured to use this number. Boards are always numbered consecutively starting with 1.
Read Configuration	Use this button to read the Fieldbus configuration for the selected Fieldbus. You must read the configuration in order for EPSON RC+ to know the devices in the bus.

Before continuing, you must click the **Read Configuration** button for each bus. This instructs EPSON RC+ to read the device configurations. If the configuration for a board is ever changed, you must Read Configuration again.

3. Operation

This chapter contains information on how to use the Fieldbus I/O option after it has been installed.

3.1 Fieldbus I/O Addressing in SPEL+

Each of the Fieldbus I/O commands in SPEL+ refer to one device on the network. The bit number and port number parameters refer to inputs and outputs local to the device.

3.2 SPEL+ Fieldbus I/O Commands

All Fieldbus I/O commands begin with the same prefix: "FbusIO_". Here are the main commands. For details, please see the online help or SPEL+ Language Reference Manual.

FbusIO_GetBusStatus	Returns the status of the specified fieldbus.
FbusIO_GetDeviceStatus	Returns the status of the specified fieldbus device.
FbusIO_In	Returns the status of an 8 bit input port.
FbusIO_InW	Returns the status of a 16 bit input port.
FbusIO_IONumber	Returns the bit number of the specified Fieldbus I/O label.
FbusIO_Off	Turns an output off.
FbusIO_On	Turns an output on.
FbusIO_Out	Simultaneously sets 8 output bits.
FbusIO_OutW	Simultaneously sets 16 output bits.
FbusIO_Sw	Returns the status of one input bit.
FbusIO_SendMsg	Sends an explicit message to a device and returns the reply.

NOTE

Response times for Fieldbus I/O can vary and depend on several factors, including baud rate, scan rate, number and types of devices, number of SPEL+ tasks, communication error, etc. When the fastest and most consistent response times are required, please use EPSON Standard digital I/O, which incorporates interrupt driven inputs and outputs.

3.3 Outputs Off by Emergency Stop and Reset Instruction

You can configure the system so that all outputs including the fieldbus outputs will be turned off when the emergency stop occurs and when a Reset instruction is executed. For details of the configuration, refer to the chapter *SPEL+ Options* in the EPSON RC+ User's Guide.

NOTE

A command that was issued just before an emergency stop can be executed after the emergency stop condition is cleared. If the outputs from the fieldbus involve risk, the "Outputs off during Emergency Stop" option should be enabled to remove all power to output devices when an emergency stop occurs.

3.4 Waiting for Input or Output Status

The SPEL+ Wait statement cannot be used for Fieldbus I/O. You can make your own function to handle this.

For example:

```
Function WaitFbusInput(bus As Integer, device As Integer,
bit As Integer, state As Integer)

  Do
    If FbusIO_Sw(bus, device, bit) = state Then
      Exit Function
    EndIf
    Wait .01
  Loop
Fend
```

In the program example above, a Wait statement is used to prevent the task from using too much CPU. You can remove the Wait for faster response, but the task will use more CPU. You may also want to add a timeout or other checks.

3.5 Using FbusIO_SendMsg

FbusIO_SendMsg is used to send an explicit message to a device and return a reply. This command operates according to the protocol.

The syntax is as follows:

FbusIO_SendMsg *bus*, *device*, *msgParam*, *sendBytes*(), *recvBytes*()

There are two arrays passed to the function. The sendData array contains the data that is sent to the device in bytes. This array must be dimensioned to the correct number of bytes to send. If there are no bytes to send, you must use 0 as the parameter. The recvData array returns the response in bytes. This array is automatically re-dimensioned to the number of bytes received.

For DeviceNet, you need to initialize the sendData array with the command, class, instance, and attribute, as shown in the example below. Consult the documentation that came with the device for the values that can be used. The msgParam parameter value is always 0 for DeviceNet messages.

Here is an example for DeviceNet, EtherNet/IP:

```
' Send explicit message to the device
Byte sendData(5)
Byte recvData(10)
Integer i
sendData(0) = 14 ' Command
sendData(1) = 1  ' Class
sendData(3) = 1  ' Instance
sendData(5) = 7  ' Attribute
FbusIO_SendMsg 1, 1, 0, sendData(), recvData()
For i = 0 To UBound(recvData)
  Print recvData(i)
Next i
```

For PROFIBUS DP, you need to specify the service number in the msgParam parameter. Consult the documentation that came with the device for the services that are supported. Some services require 0 send bytes. In this case, use 0 for the sendBytes parameter.

Here is an example for PROFIBUS DP:

```
' Send message to Profibus device
Byte recvData(10)
Integer i
' Service 56 - read all inputs
' sendBytes = 0
FbusIO_SendMsg 2, 1, 56, 0, recvData()
For i = 0 To UBound(recvData)
  Print recvData(i)
Next i
```

3.6 Using Slave Mode

In slave mode, the EPSON RC+ system is a slave on the bus. Outputs from the master are inputs in EPSON RC+, and inputs to the master are outputs in EPSON RC+.

Uses for slave mode:

- External equipment can monitor data in the controller
- Remote control

To use the system in slave mode, perform the following basic steps:

1. Configure local slave on the Fieldbus scanner board. Refer to the *2. Installation* for instructions for the type of hardware you are using.
2. Design your application to handle requests from the Fieldbus master and return data or execute functions.

3.7 Remote Control Slave

If the controller will be remotely controlled by a Fieldbus master, your application must auto start and run in a continuous loop to service requests from the master. Use OnErr, Trap Error, Trap Emergency and Restart to accomplish this. Refer to the sample project for Fieldbus remote slave called *FieldbusRemoteSlave* that is included with EPSON RC+.

3.8 Devices available for Fieldbus I/O Option

The fieldbus I/O option operations were checked with the following devices.

NOTE

The following information about the devices is just for reference. This is not our guarantee of the proper operation of these devices.

DeviceNet Devices

Specifications	Model Number	Manufacturer
16-input module	TDN-8C0-108	Woodhead
8-output module	TDN-808-118	Woodhead
Intelligent I/O module	750-346	WAGO
4-channel digital input module	750-431	WAGO
4-channel digital output module	750-530	WAGO
Photo sensor	42GNP-9000-QD1	Allen-Bradley
Motor Driver I/F	JUSP-NS300	YASKAWA ELECTRIC
Motor Driver	SGDH	YASKAWA ELECTRIC
RC170 DeviceNet option	RC170	SEIKO EPSON

PROFIBUS DP Device

Specifications	Model Number	Manufacturer
16-input module	TDP-8C0-B18-02	Woodhead
16-output module	TDN-808-B18-02	Woodhead
Intelligent I/O module	750-343	WAGO
4-channel digital input module	750-431	WAGO
4-channel digital output module	750-530	WAGO
Motor Driver I/F	JUSP-NS500	YASKAWA ELECTRIC
Motor Driver	SGDH	YASKAWA ELECTRIC
RC170 PROFIBUS-DP option	RC170	SEIKO EPSON

3.9 Fieldbus I/O Response Performance

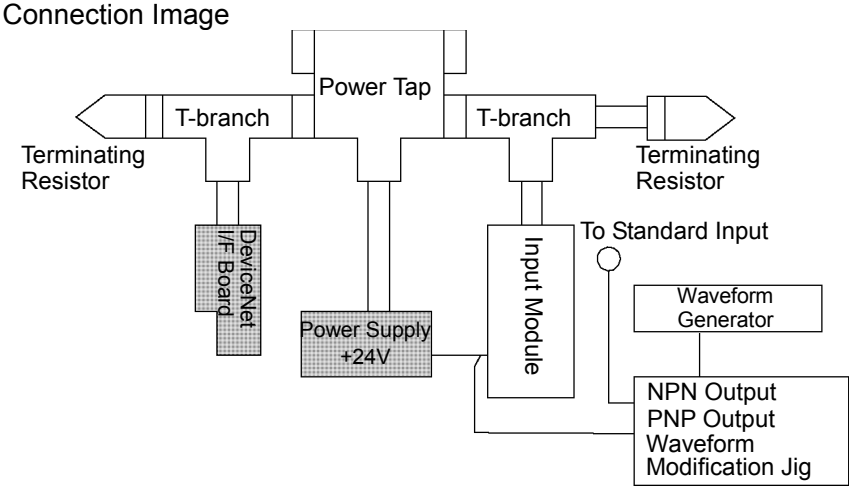
As mentioned previously, respond times for fieldbus I/O can vary and depend on several factors. The values in this section are shown for reference not for guaranteed performance.

DeviceNet

Test Environment

RC520 Controller: Pentium III 850 MHz 128 MB memory
Fieldbus I/O: PCI-DVNIO board Master (MAC ID: 0)
Baud rate: 500 kbps, 125 kbps
Connected Slave: Woodhead 16-input module (TDN-8C0-108)
Node address: 2

Connection Image



Evaluation

Signals with various pulse widths (every 5 msec) were input to the standard I/O input and the input module of the fieldbus I/O at 1 Hz. For 10 minutes (600 seconds), pulse widths of the received signals were measured at 125 kbps and 500 kbps.

Result

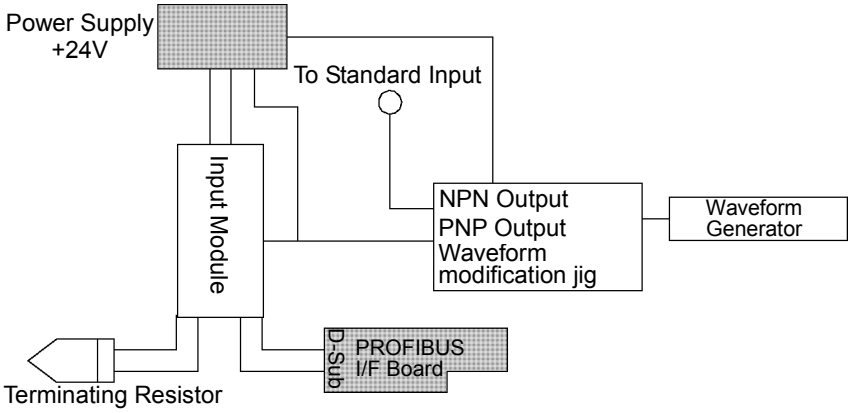
500 kbps: The input devices responded to 25-msec pulse.
125 kbps: The input devices responded to 30-msec pulse.

PROFIBUS DP

Test Environment

RC520 Controller: Pentium III 850 MHz 128 MB memory
Fieldbus I/O: PCI-DPIO board Master (station address: 0)
Baud rate: 12 Mbps, 9.6 kbps
Connected Slave: Woodhead 16-inpout module (TDP-8C0-B18-02)
Node address: 2

Connection Image



Evaluation

Signals with various pulse widths (every 5 msec) were input to the standard I/O input and the input module of the fieldbus I/O at 1 Hz. For 10 minutes (600 seconds), pulse widths of the received signals were measured at 12 Mbps and 9.6 kbps.

Result

12 Mbps: The input devices responded to 25-msec pulse.
9.6 kbps: The input devices responded to 80-msec pulse.

4. Troubleshooting

4.1 DeviceNet Troubleshooting

Exclusion

Every system has its special environment, conditions, specifications, and usages. This guide is provided as a general reference for troubleshooting a DeviceNet network. Every effort has been made to ensure the information is accurate. However, we do not guarantee the complete accuracy of the information and thus we decline any liability for damages or costs incurred by the use of this troubleshooting.

Before examining a problem on the network, please ensure that your established DeviceNet system satisfies network specifications. (Refer to this troubleshooting and the section *2.2 DeviceNet Network Construction*.)

Tools

Prepare the following tools for troubleshooting.

Philips screwdriver

Flat-blade screwdriver

Tester

HINT

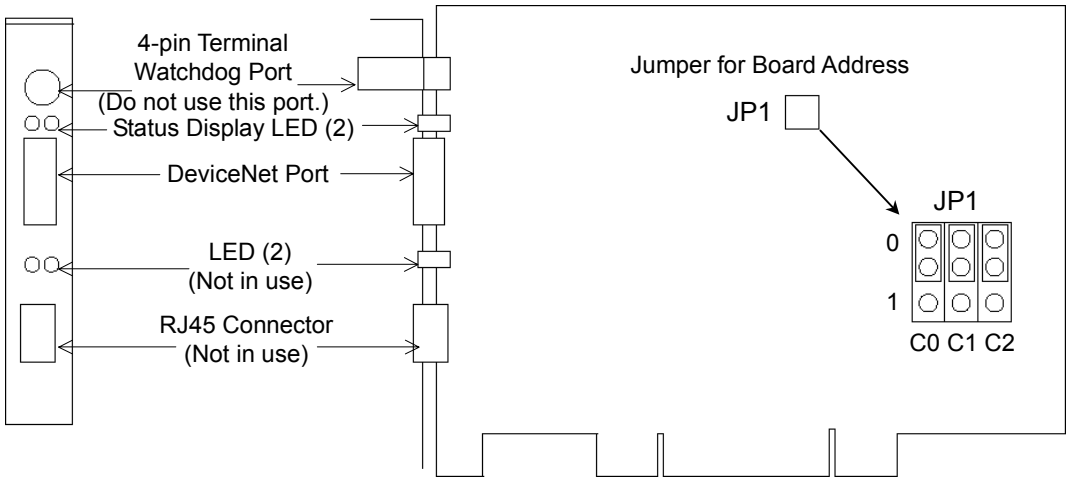
Using the Woodhead NetMeter (DeviceNet diagnostic tool) is a simple way to learn physical status of the DeviceNet network. For details of NetMeter, see Woodhead's Web site (http://www.mysst.com/diagnostics/NetMeter.asp).

4.1.1 Examining a Problem

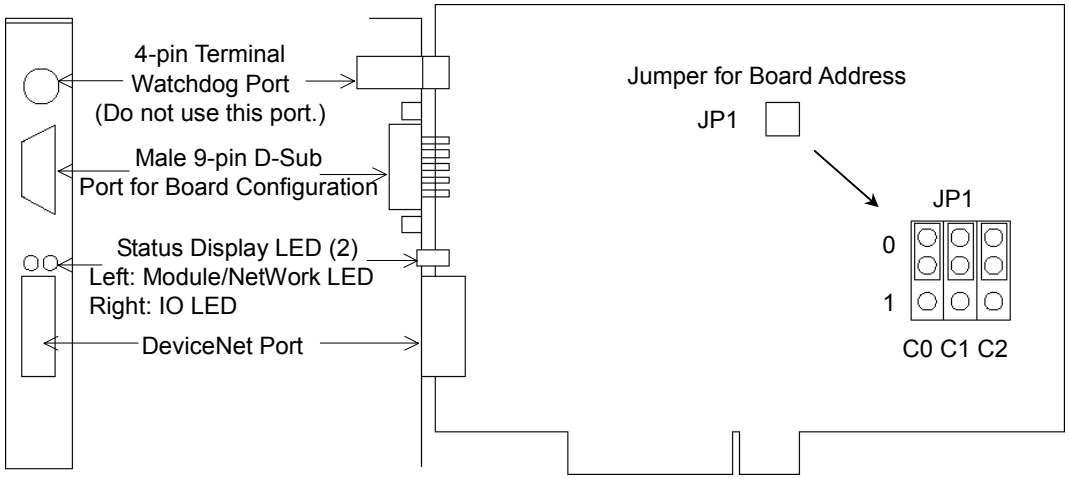
4.1.1.1 Scanner Board Diagnostic LEDs

The DeviceNet board used with EPSON RC+ has two status display LEDs. The layout of the LEDs is shown in the following figure.

PCU-DVNIO



PCI-DVNIO



The Module/NetWork LED is on the left and the IO LED is on the right seen from the rear panel. These LED names are used in applicomIO Console application and this manual. Only in this troubleshooting section, general names of the status display of the DeviceNet device are used instead.

The Module/NetWork LED is expressed by the Network Status (NS) in this section.

The IO LED is expressed by the Module Status LED (MS) in this section.

4.1.1.2 Check Network Status

(1) Master Status: MS/NS LEDs

LED	Color		Light Condition		
MS (Module Status)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF
NS (Network Status)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF

(2) Node Number of Absent Slaves

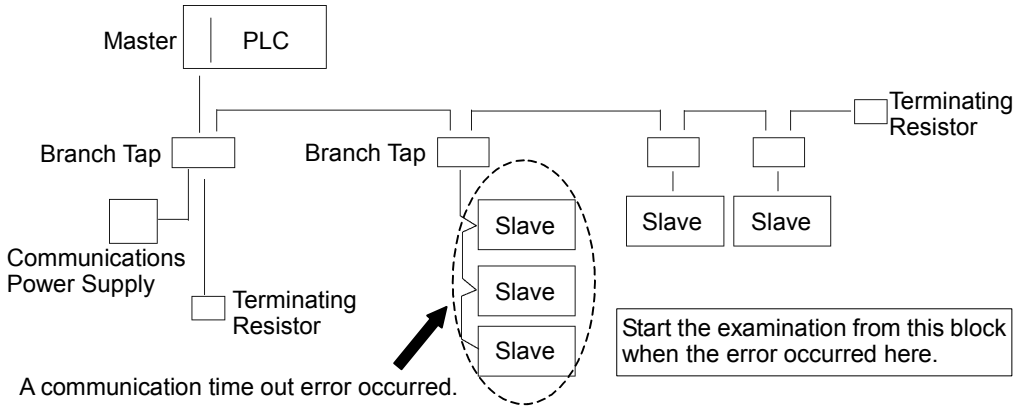
Absent slaves are disconnected from or not added to the network.

1. See the status flag regarding to the removal and addition if the master has status information.
2. See the MS/NE LEDs of all slaves if the master has no status information.

(3) Absent Slave Status: MS/NS LEDs

LED	Color		Light Condition		
MS (Module Status)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF
NS (Network Status)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF

(4) Physical Node Location of Absent Slave



(5) Error Occurrence Condition

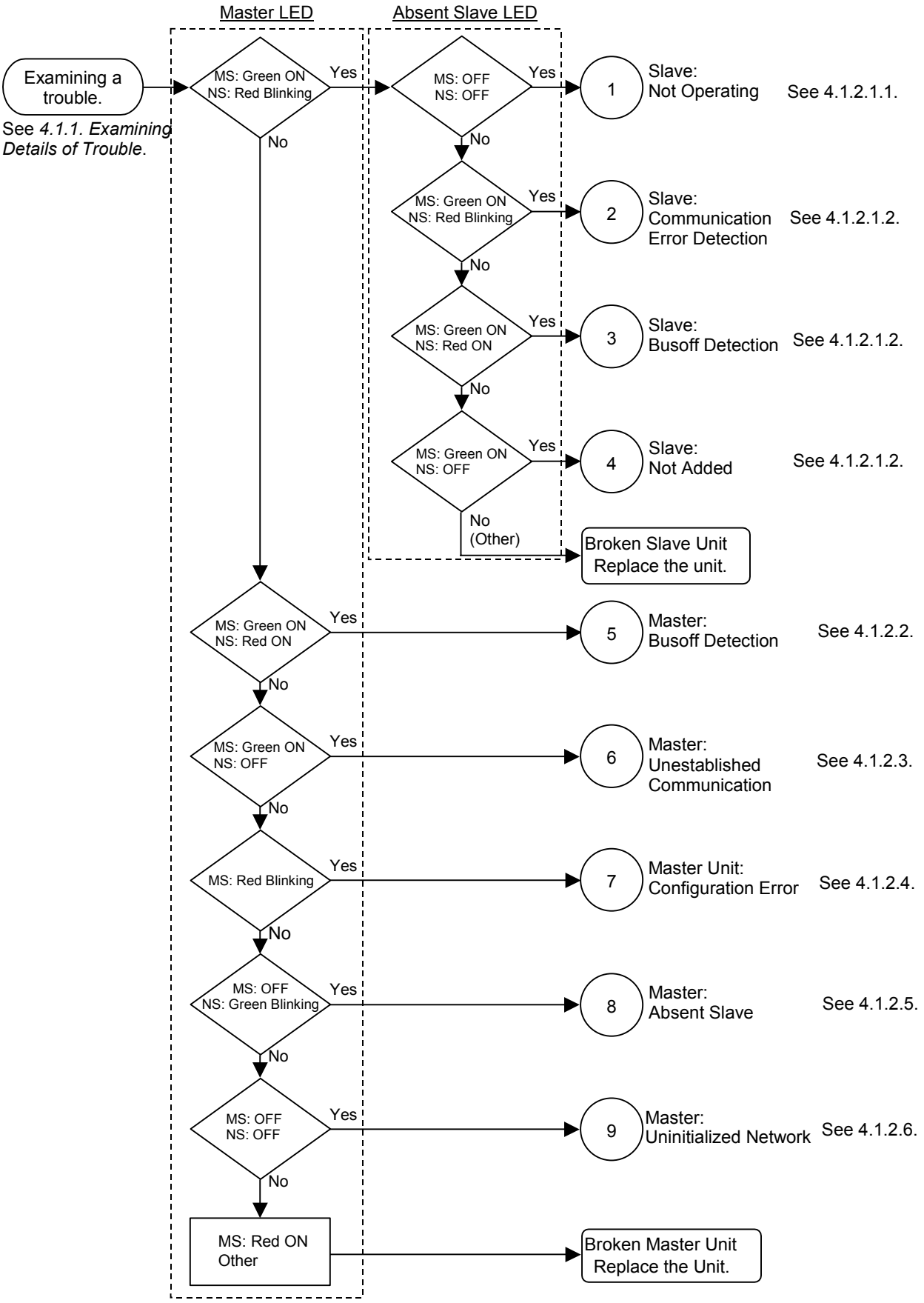
☐ Immediate occurrence (high reproducibility)

☐ Rare occurrence (low reproducibility)

4.1.2 Problems and Countermeasures

Master Unit LED		Error	Description [Reference]
MS	NS		
Green Light ON	Green Light ON	Normal communication	- Normal condition
Green Light ON	Green Light Blinking	During connection establishment	- Processing connection establishment (The NS LED will be ON in green in a few seconds.) - Master function in stop state (When communication does not start, master analysis with NetMeter is required.)
Green Light ON	Red Light Blinking	Communication error	[Refer to the section *4.1.2.1 Master: Communication Error*.] - Slave disconnected from the network (Remote I/O communication error) - Slave not added to the network (Scan list collation error) - Communications power supply OFF (Error detection after the communication establishment)
Green Light ON	Red Light ON	Busoff detection Duplicate MAC ID	[Refer to the section *4.1.2.2 Master: Busoff Detection*.] - Busoff detection: Communication stopped due to critical error. - Duplicate MAC ID: The MAC ID configuration was duplicated. (This error occurs only during unit start-up)
Green Light ON	Light OFF	Unestablished communication	[Refer to the section *4.1.2.3 Master: Unestablished Communication*.] - No slave (Error detection before communication establishment) - Communications power supply OFF (Error detection before the communication establishment) - Duplicate MAC ID: The MAC ID configuration was duplicated.
Red Light Blinking	No Matter	Configuration error	- Master unit configuration error Refer to the respective device manuals. [Refer to the section *4.1.2.4 Master: Configuration Error*.] When EPSON RC+ was configured as a master: - Slave disconnected from the network (Remote I/O communication error) - Slave not added to the network (Scan list collation error) - Duplicate MAC ID: The MAC ID configuration was duplicated.
Red Light ON	No Matter	Module error	- Broken master unit → Unit Replacement
Light OFF	Green Light Blinking	Absent slave	[Refer to the section *4.1.2.5 Absent Slave*.] - No slave (Error detection before communication establishment) - Communications power supply OFF
Light OFF	Light OFF	Uninitialized network Absent slave	[Refer to the section *4.1.2.6 Uninitialized Network*.] - Master unit start-up error - No slave (Error detection before communication establishment) - Communications power supply OFF

♦ Process Flowchart



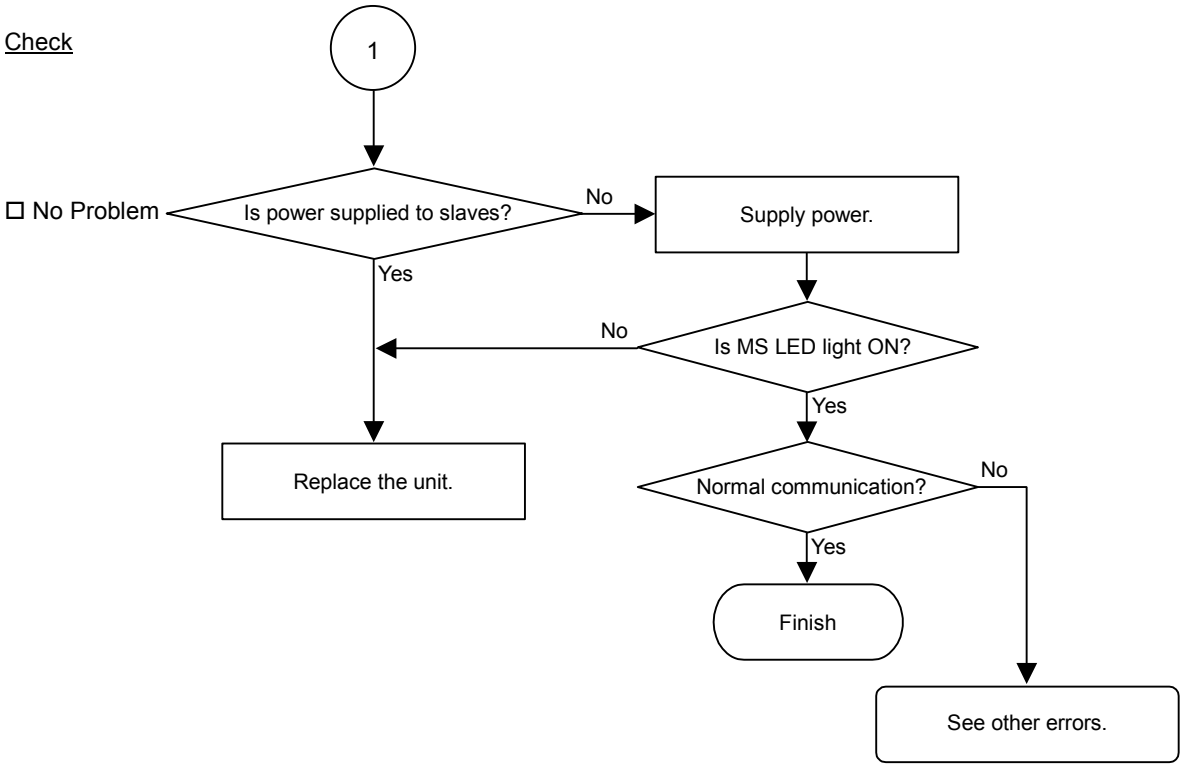
4.1.2.1 Master: Communication Error

Master Unit LED		Error	Description
MS	NS		
Green Light ON	Red Light Blinking	Communication error	- Slave disconnected from the network (Remote I/O communication error) - Slave not added to the network (Scan list collation error) - Communications power supply OFF (Error detection after the communication establishment)

4.1.2.1.1 Slave: Not Operating

	MS	NS
Master LED Condition	Green Light ON	Red Light Blinking
Absent Slave LED Condition	Light OFF	Light OFF

♦ Process Flowchart



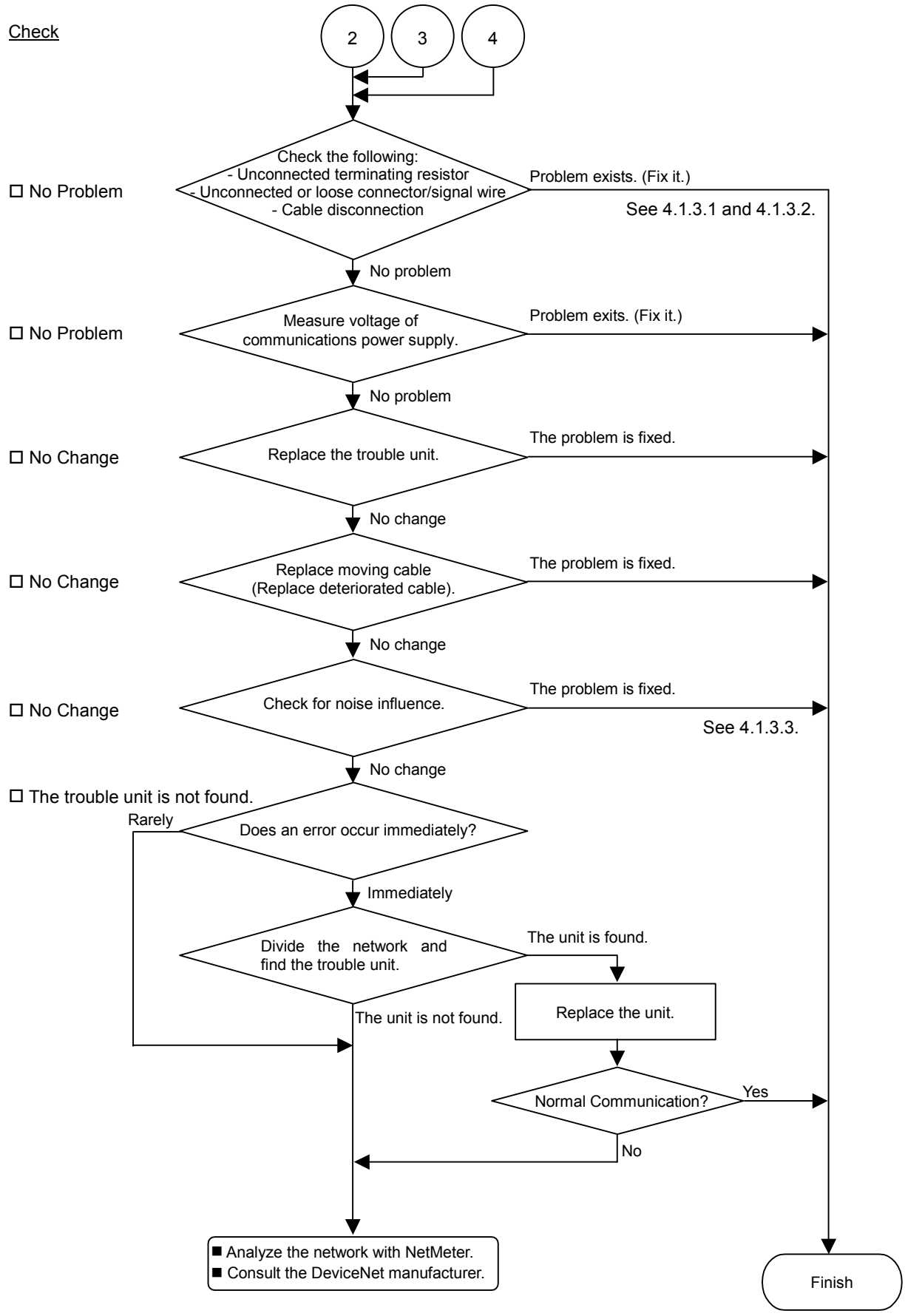
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Slave power OFF	Measure the power voltage of the slaves. (It should be within the range of sufficient voltage for the slave operation.) NOTE: For slaves operating with communications power supply, measure voltage at the DeviceNet connector.	Supply power to the slave.
○ Broken unit	Slave unit replacement	Replace the broken slave unit with a new one.

4.1.2.1.2 Slave: Communication Error Detection / Busoff Detection / Not-added

	MS	NS
Master LED Condition	Green Light ON	Red Light Blinking
(1) Absent Slave LED Condition (Communication error detection)	Green Light ON	Red Light Blinking
(2) Absent Slave LED Condition (Busoff detection)	Green Light ON	Red Light ON
(3) Absent Slave LED Condition (Slave not added to the network)	Green Light ON	Light OFF

♦ Process Flowchart



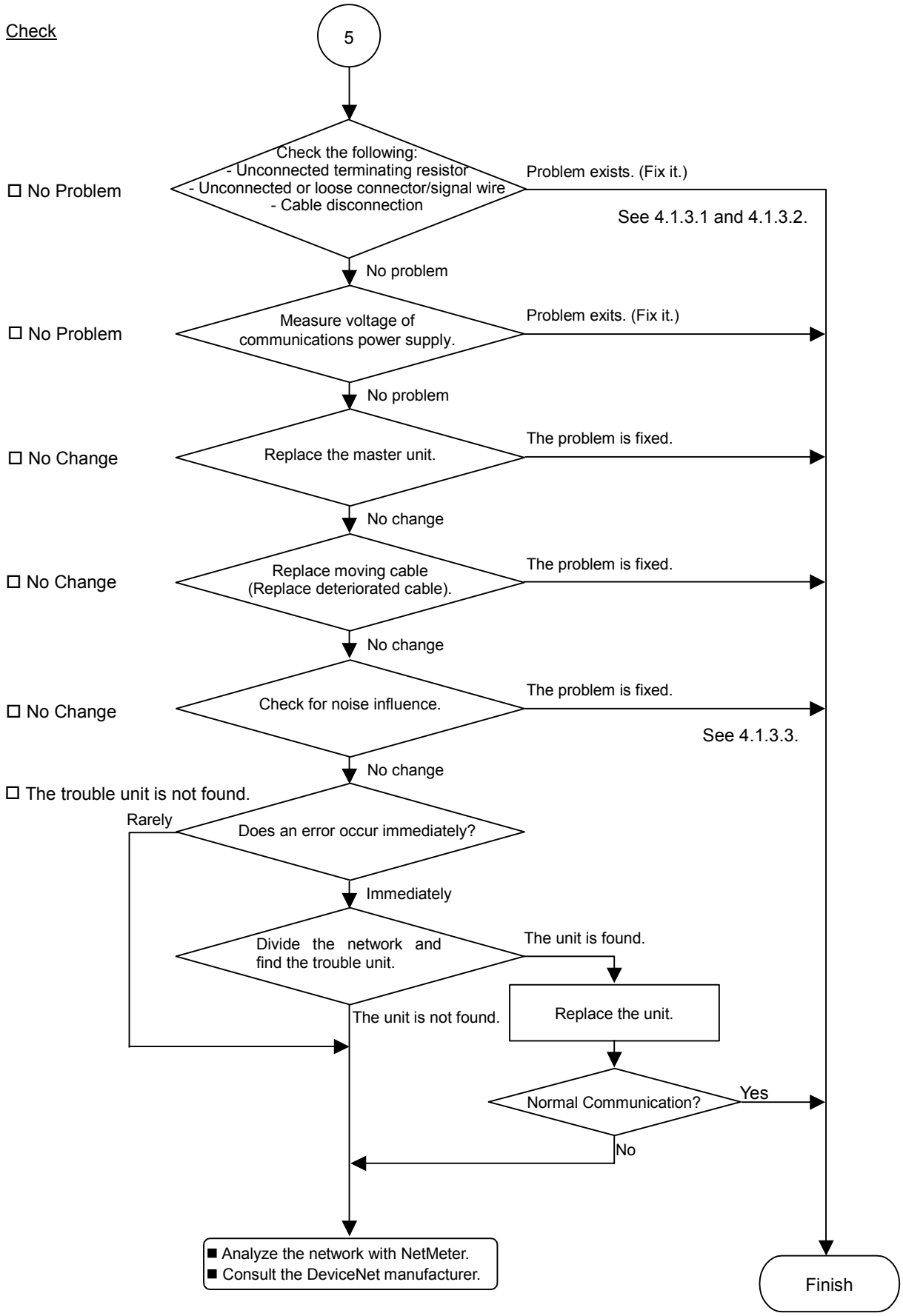
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with communications power supply OFF. → Normal: 50 to 70 Ω ● Measuring point: Connection of the trouble unit ● For detail, refer to the section *4.1.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 120 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: all nodes and all branch taps ● For details, refer to the section *4.1.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ Voltage drop of communications power supply	Measure voltage of communications power supply at the unit with a trouble. → Normal: 11V or more between V+ and V- ● If the voltage is 11 to 14 V, the unit is a possible cause. Fix the problem on the unit.	Check the voltage of the power supply. Calculate the current capacity of the cable and add more communications power supplies.
○ Noise (external cause)	Check the noise intrusion via the following paths (1) to (3). (1) Noise via DRAIN (FG) (2) Induced noise via communication cable (3) Communications power supply → For details, refer to the section *4.1.3.3 Noise Intrusion*.	Take countermeasures against noise.
○ Broken unit	Replace the broken unit with a new one. → Verify whether the problem is fixed.	Replace the unit with a new one.
● No cause is identified.	Identify the trouble point by dividing the network. → For details, refer to the section *4.1.3.4 Broken Unit Examination*.	

4.1.2.2 Master: Busoff Detection

Master Unit LED		Error	Description
MS	NS		
Green Light ON	Red Light ON	Busoff detection	Communication stopped due to critical error.
		Duplicate MAC ID	The MAC ID configuration was duplicated. (This error occurs only during unit start-up)

♦ Process Flowchart



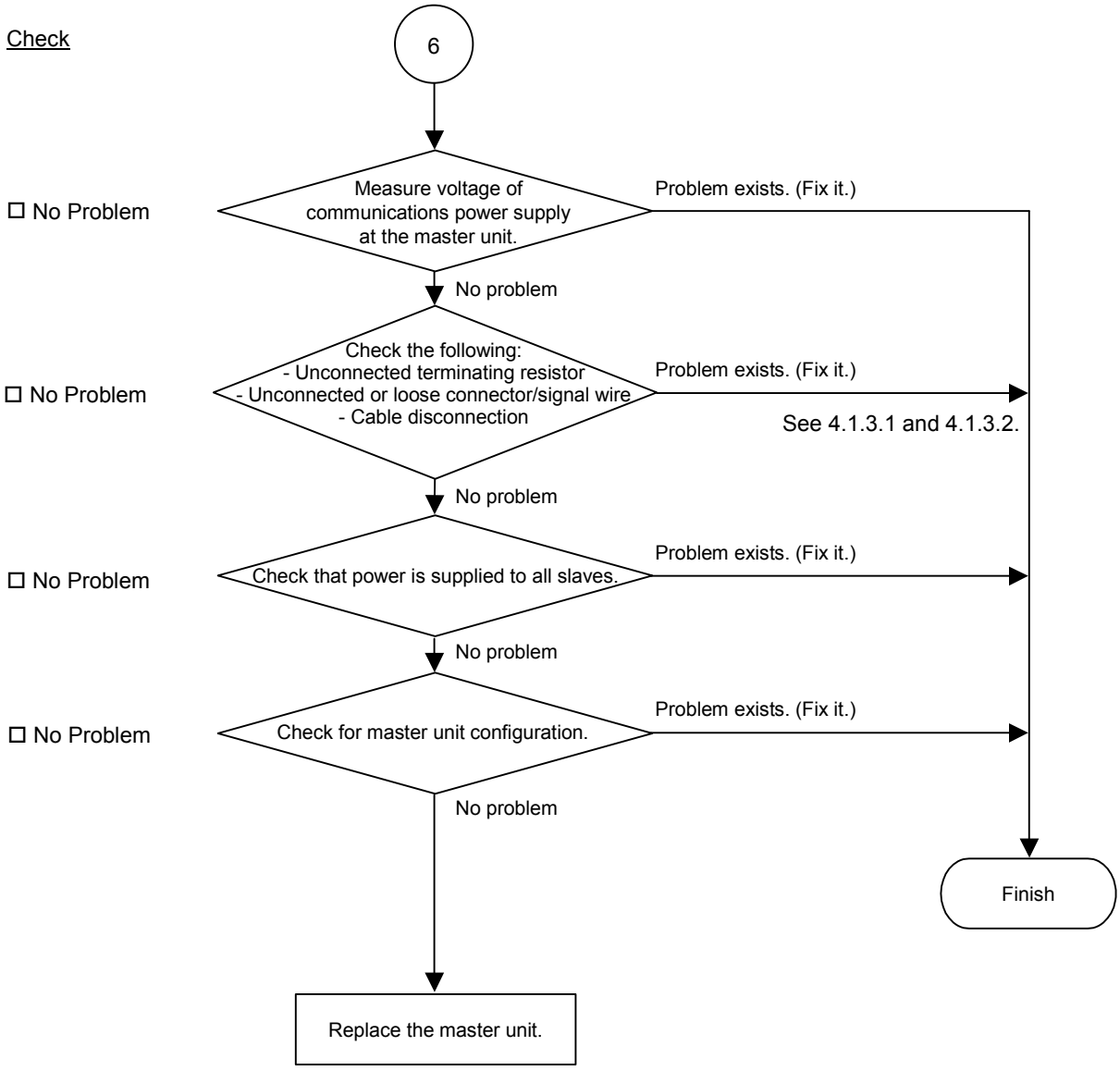
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with communications power supply OFF. → Normal: 50 to 70 Ω ● Measuring point: Connection of the problem unit ● For detail, refer to the section *4.1.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 120 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: all nodes and all branch taps ● For details, refer to the section *4.1.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ Voltage drop of communications power supply	Measure voltage of communications power supply at the trouble unit. → Normal: 11V or more between V+ and V- ● If the voltage is 11 to 14 V, the unit is a possible cause. Fix the problem on the unit.	Check the voltage of the power supply. Calculate the current capacity of the cable and add more communications power supplies.
○ Noise (external cause)	Check the noise intrusion via the following paths (1) to (3). (1) Noise via DRAIN (FG) (2) Induced noise via communication cable (3) Communications power supply → For details, refer to the section *4.1.3.3 Noise Intrusion*.	Take countermeasures against noise.
○ Broken unit	Replace the broken unit with a new one. → Verify whether the problem is fixed.	Replace the unit with a new one.
● No cause is identified.	Identify the trouble point by dividing the network. → For details, refer to the section *4.1.3.4 Broken Unit Examination*.	

4.1.2.3 Master: Unestablished Communication

Master Unit LED		Error	Description
MS	NS		
Green Light ON	Light OFF	Master Unestablished communication	Communications power supply OFF No slave

♦ Process Flowchart



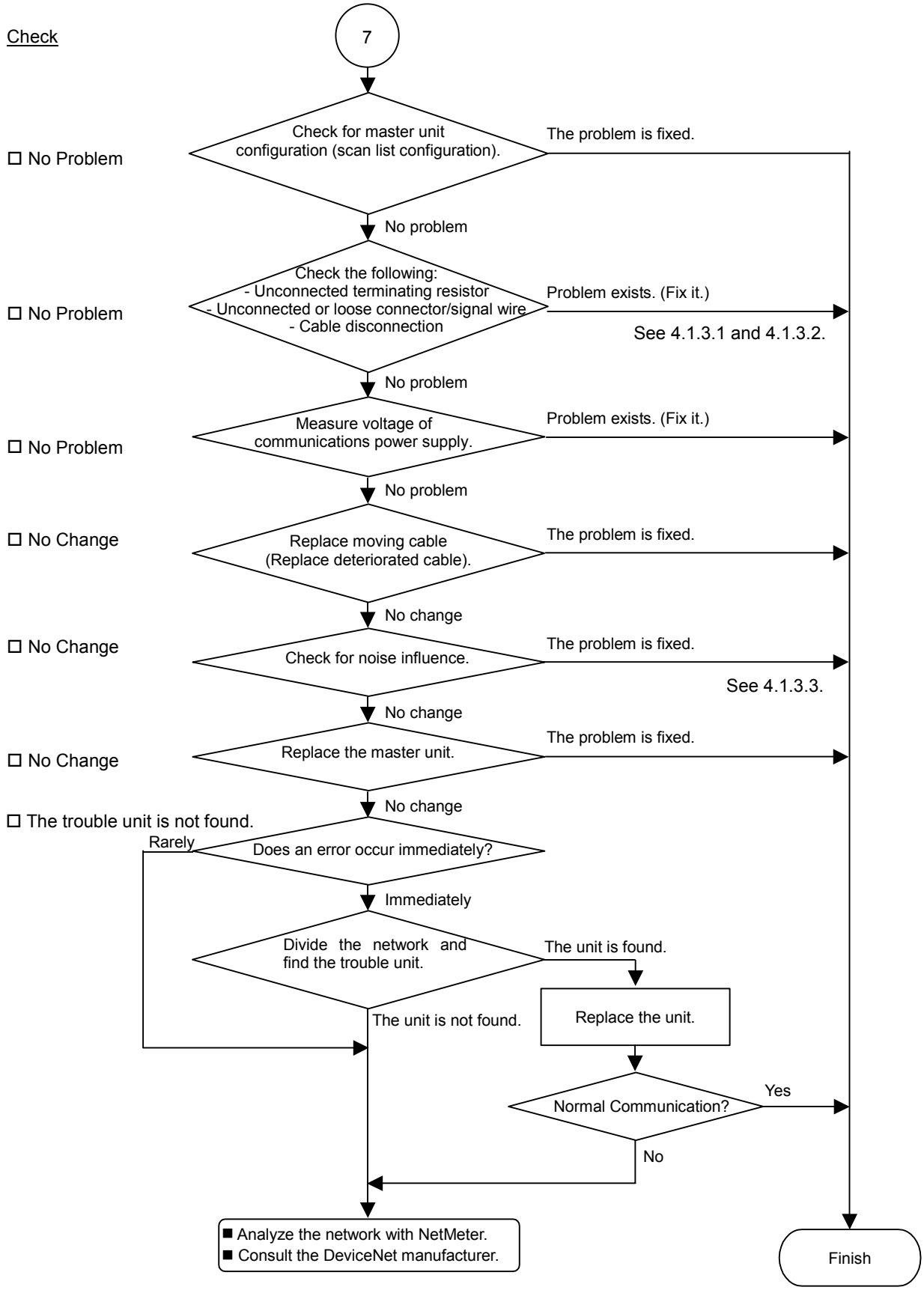
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Voltage drop of communications power supply	Measure voltage of communications power supply at the master unit. → Normal: 11V or more between V+ and V- ● If the voltage is 11 to 14 V, the master unit is a possible cause. Fix the problem on it.	Check voltage of the power supply.
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with communications power supply OFF. → Normal: 50 to 70 Ω ● Measuring point: Connection of the master ● For detail, refer to the section *4.1.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 120 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: Between the master and its slaves ● For details, refer to the section *4.1.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ All slaves power OFF	Measure the power voltage of the slaves. (It should be within the range of sufficient voltage for slave operation.)	Supply power to the slaves.
○ Master unit configuration	(1) Start applicomIO Console application and check that the configuration has no difference with the network condition. (2) Check that the configuration data were written in flash. ● For details, refer to the section *4.1.3.6 EPSON RC+ Master Configuration*.	Change the configuration.

4.1.2.4 Master: Configuration Error

Master Unit LED		Error	Description
MS	NS		
Red Light Blinking	No Matter	Configuration error Slave error detection	- Slave disconnected from the network (Remote I/O communication error) - Slave not added to the network (Scan list collation error) - Duplicate MAC ID: The MAC ID configuration was duplicated.

♦ Process Flowchart



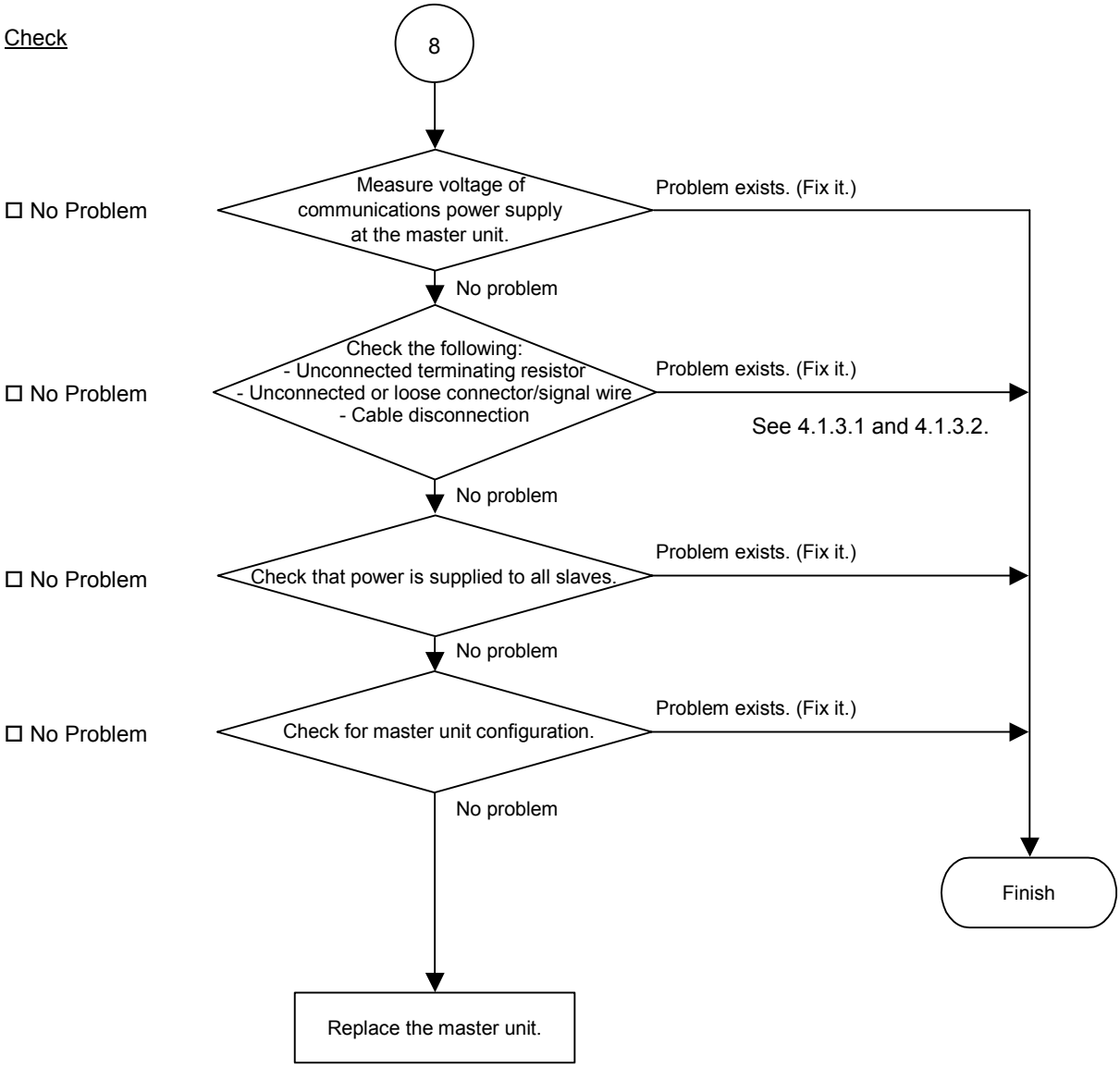
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Master unit configuration	(1) Start applicomIO Console application and check that the configuration has no difference with the network condition. (2) Check that the configuration data were written in flash. (3) Check that the network load is within allowable range. ● For details, refer to the section *4.1.3.6 EPSON RC+ Master Configuration*.	Change the configuration.
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with communications power supply OFF. → Normal: 50 to 70 Ω ● Measuring point: Connection of the trouble unit ● For detail, refer to the section *4.1.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 120 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: all nodes and all branch taps ● For details, refer to the section *4.1.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ Voltage drop of communications power supply	Measure voltage of communications power supply at the unit with a trouble. → Normal: 11V or more between V+ and V- ● If the voltage is 11 to 14 V, the unit is a possible cause. Fix the problem on the unit.	Check the voltage of the power supply. Calculate the current capacity of the cable and add more communications power supplies.
○ Noise (external cause)	Check the noise intrusion via the following paths (1) to (3). (1) Noise via DRAIN (FG) (2) Induced noise via communication cable (3) Communications power supply → For details, refer to the section *4.1.3.3 Noise Intrusion*.	Take countermeasures against noise.
○ Broken unit	Replace the broken unit with a new one. → Verify whether the problem is fixed.	Replace the unit with a new one.
● No cause is identified.	Identify the trouble point by dividing the network. → For details, refer to the section *4.1.3.4 Broken Unit Examination*.	

4.1.2.5 Absent Slave

Master Unit LED		Error	Description
MS	NS		
Light OFF	Green Light Blinking	Absent slave	- No slave (Error detection before communication establishment) - Communications power supply OFF

♦ Process Flowchart



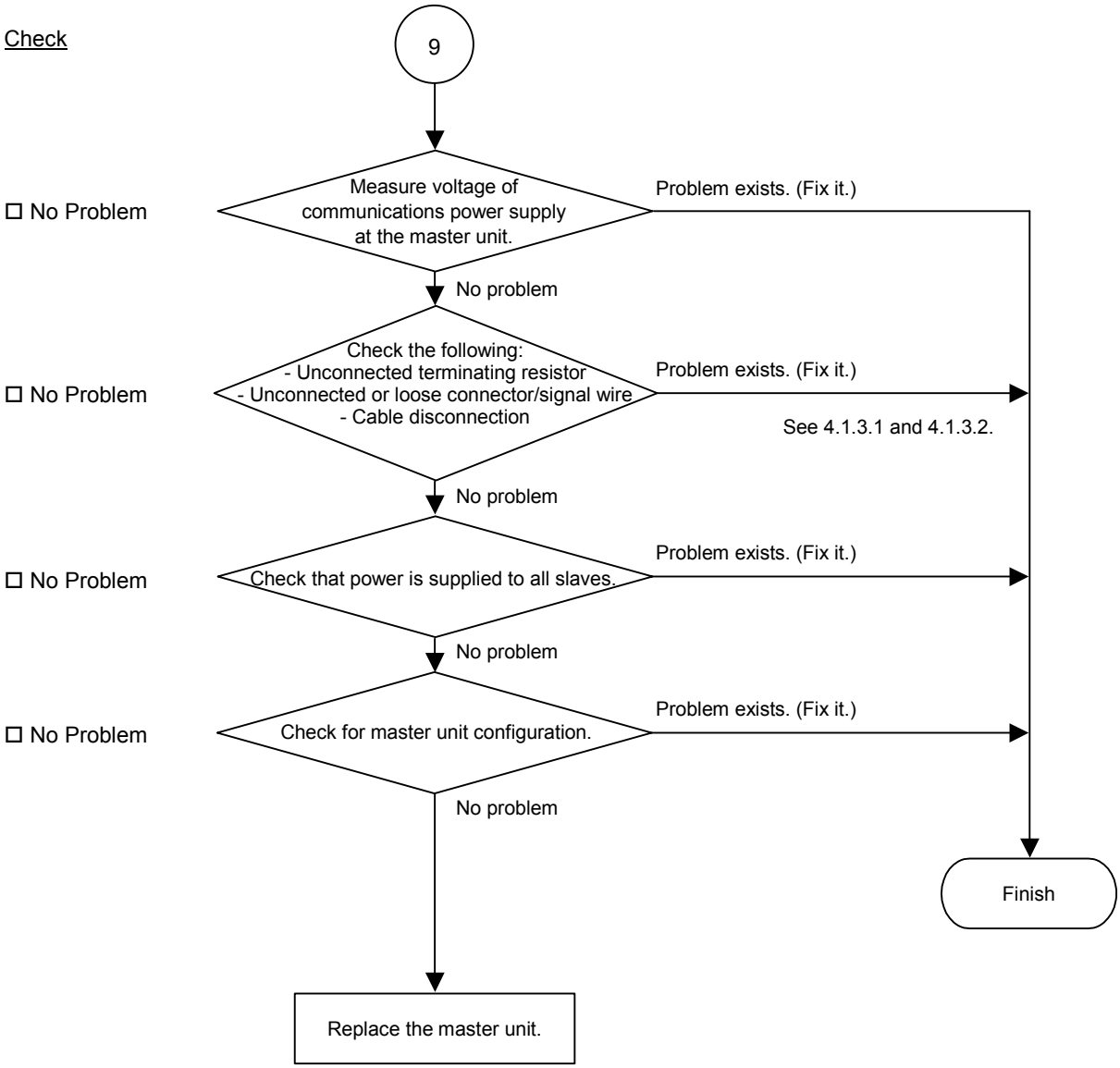
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Voltage drop of communications power supply	Measure voltage of communications power supply at the master unit. → Normal: 11V or more between V+ and V- ● If the voltage is 11 to 14 V, the unit is a possible cause. Fix the problem on the unit.	Check voltage of the power supply.
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with communications power supply OFF. → Normal: 50 to 70 Ω ● Measuring point: Connection of the master ● For detail, refer to the section *4.1.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 120 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: Between the master and its slaves ● For details, refer to the section *4.1.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ All slaves power OFF	Measure the power voltage of the slaves. (It should be within the range of sufficient voltage for the slave operation.)	Supply power to the slaves.
○ Master unit configuration	(1) Start applicomIO Console application and check that the configuration has no difference with the network condition. (2) Check that the configuration data were written in flash. ● For details, refer to the section *4.1.3.6 EPSON RC+ Master Configuration*.	Change the configuration.

4.1.2.6 Uninitialized Network

Master Unit LED		Error	Description
MS	NS		
Light OFF	Light OFF	Uninitialized network Absent slave	- Master unit start-up error - No slave (Error detection before communication establishment) - Communications power supply OFF

♦ Process Flowchart



♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Voltage drop of communications power supply	Measure voltage of communications power supply at the master unit. → Normal: 11V or more between V+ and V- ● If the voltage is 11 to 14 V, the master unit is a possible cause. Fix the problem on it.	Check voltage of the power supply.
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with communications power supply OFF. → Normal: 50 to 70 Ω ● Measuring point: Connection of the master ● For detail, refer to the section *4.1.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 120 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: Between the master and its slaves ● For details, refer to the section *4.1.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ All slaves power OFF	Measure the power voltage of the slaves. (It should be within the range of sufficient voltage for slave operation.)	Supply power to the slaves.
○ Master unit configuration	(1) Start applicomIO Console application and check that the configuration has no difference with the network condition. (2) Check that the configuration data were written in flash. ● For details, refer to the section *4.1.3.6 EPSON RC+ Master Configuration*.	Change the configuration.

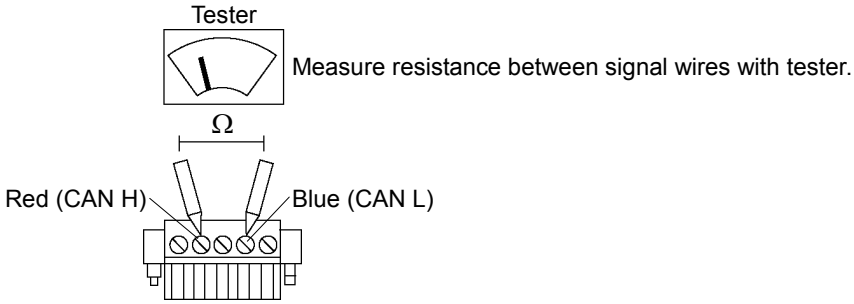
4.1.3 Procedures for Examining Possible Causes

4.1.3.1 Connection Problem (Disconnected Terminating Resistors, Cable Disconnection, Disconnected Connector, Disconnected Signal Wire)

(1) Ensure that two terminating resistors are connected to both ends of the network.

(2) Turn OFF the communications power supply.

(3) Measure resistance between CAN_H and CAN_L wires of the absent slave using the tester.

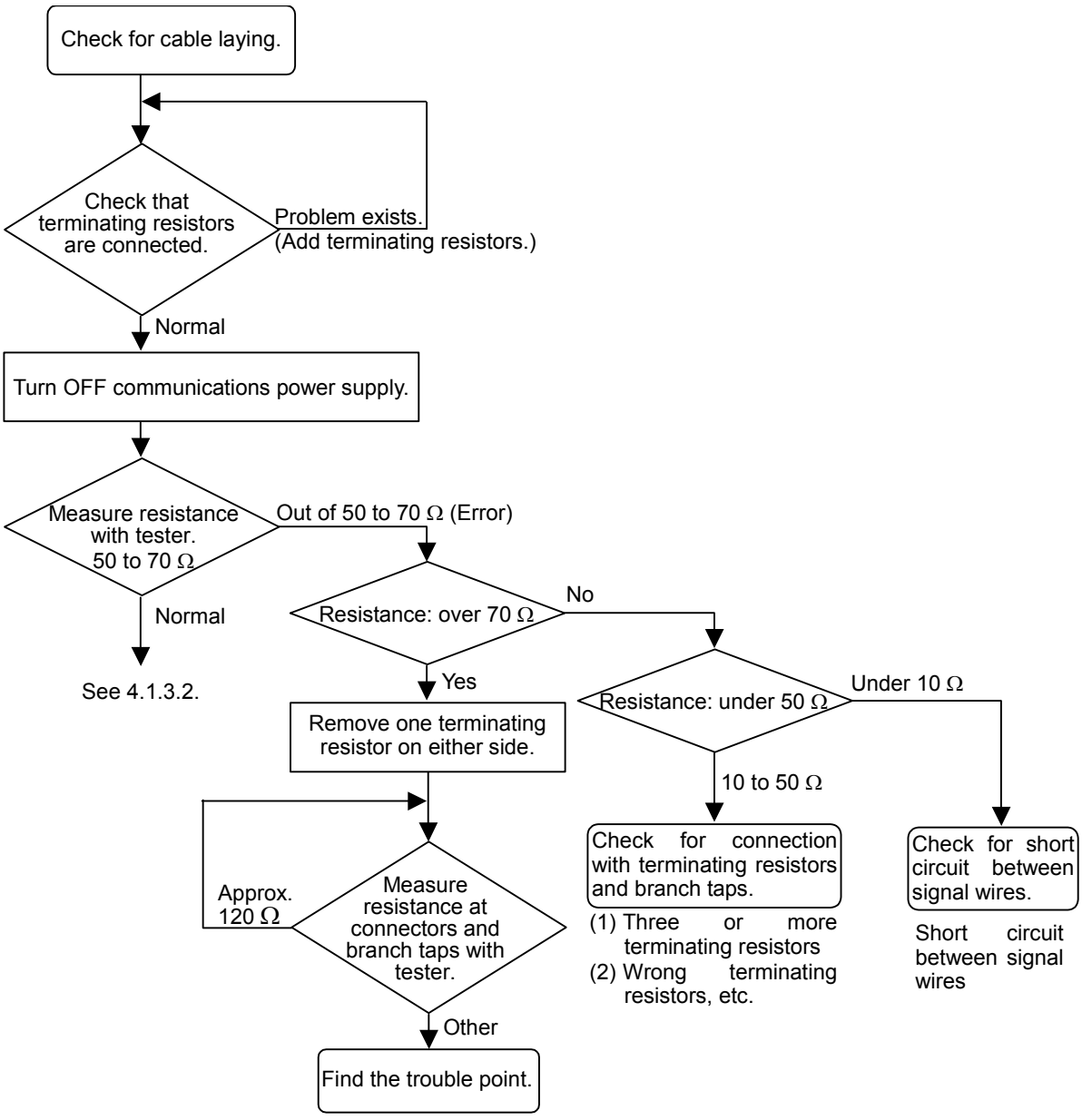


Resistance	Determination
0 Ω	Shot circuit
Under 50 Ω	Three or more terminating resistors on one network
50 to 70 Ω	Normal
70 to 120 Ω	Error (cable disconnection or disconnected signal wire on the trunk line)
Over 120 Ω	Error (cable disconnection or disconnected signal wire on drop line or trunk line → Both CAN_H and CAN_L)

(4) How to find the trouble point:

- Remove the terminating resistor on one end of the network.
  (The resistance at the point where the terminating resistor is connected is 120 Ω.)
- Measure resistance at branch taps of all units.
- The trouble point is where resistance changes from 120 Ω.
- After finding the trouble point, verify the connector and cable conditions.

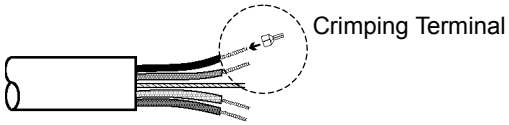
♦ Process Flowchart



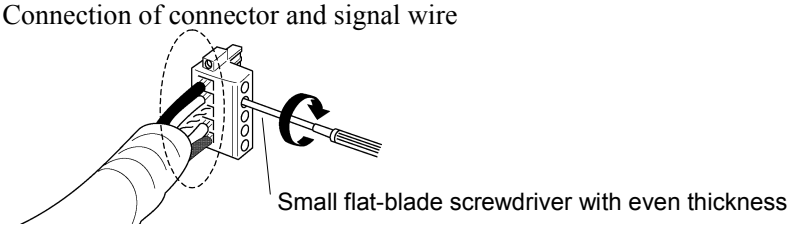
4.1.3.2 Loose Connector and Signal Wire

Check for the connections of the following parts on the connector and cable.

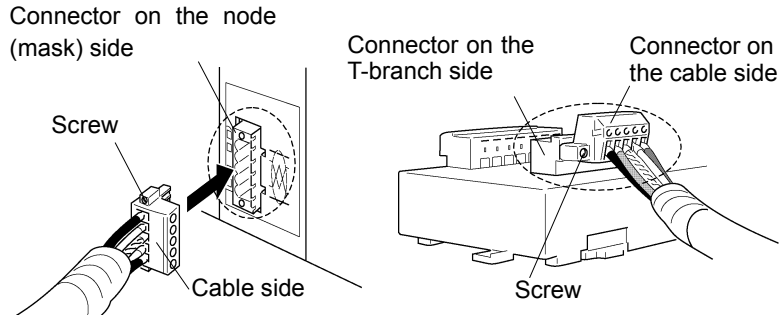
(1) Crimp Terminal

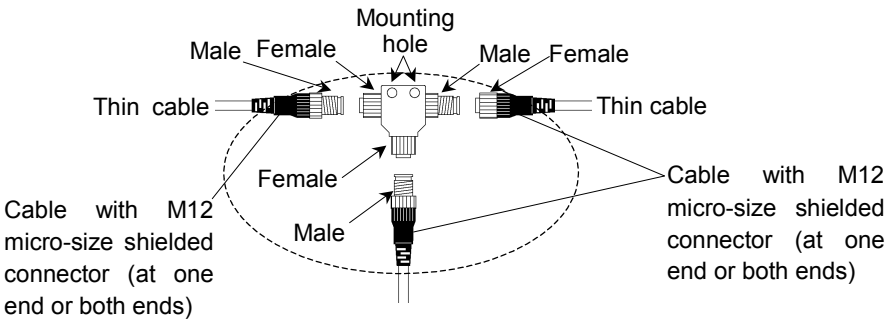


(2) Connection of connector and signal wire



(3) Connection of connector and unit (T-branch tap)



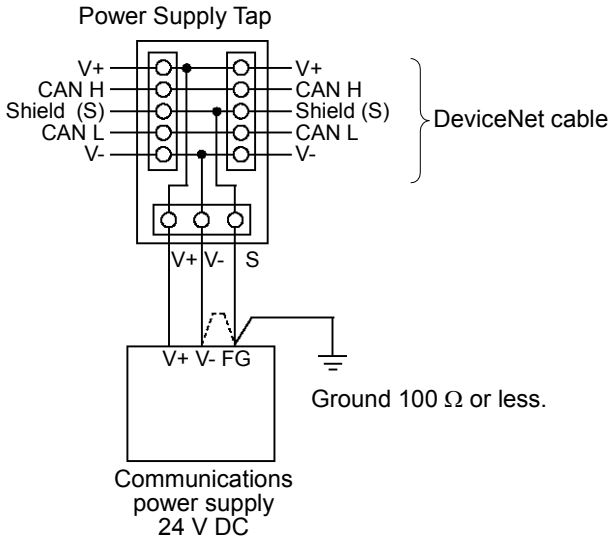


4.1.3.3 Noise Intrusion

Verify how an error occurrence condition changes while taking the following countermeasures.

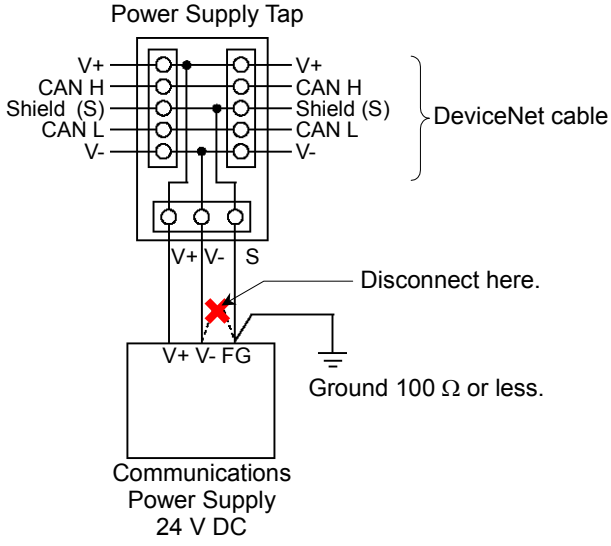
♦ Ground of FG (DRAIN) wire

Normal Grounding: Ground the DeviceNet network at only one point.



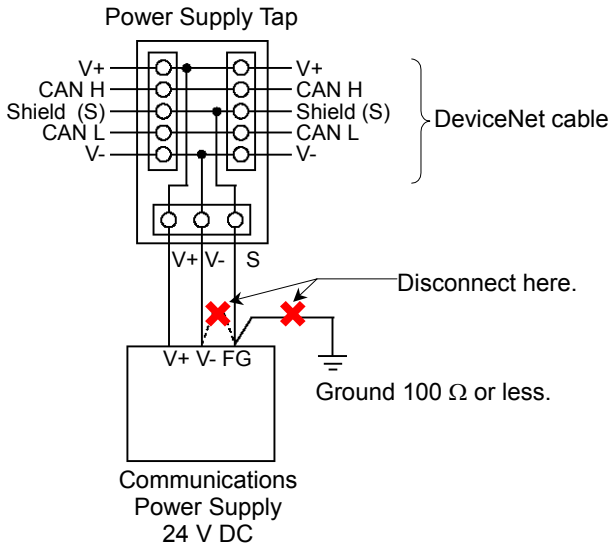
Countermeasure 1: Disconnect the wire between V- and FG.

Disconnect the wire between V- and FG when you cannot ground the FG wire.



Countermeasure 2: Disconnect the shield wire to isolate it from the ground.

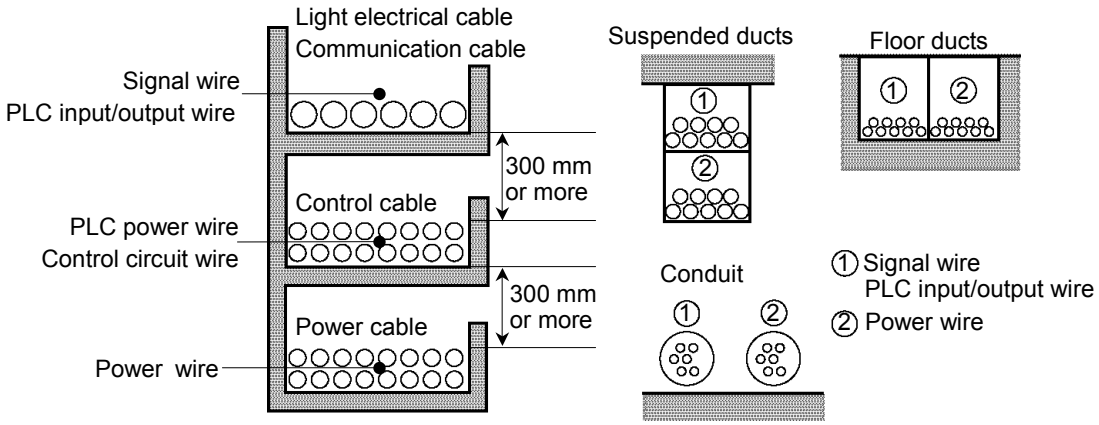
When noise intrudes the ground line because a noise source such as an inverter is installed near the communications power supply, disconnect the shield wire of the communication cable and isolate it from the ground to restrain noise intrusion.



♦ Induced noise via communication cable

Separate the DeviceNet signal wire from the other wires (especially power wires).

* Separate the signal wire from the power wires 300 mm or more.

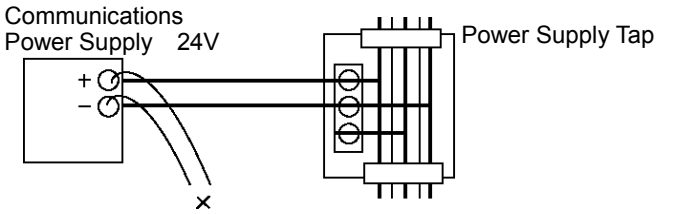


During site inspection, bypass the wire that is possibly affected by induced noise with other cables and then lay the cables. Establish the communication under no induced noise condition and verify whether an error occurs.

♦ Communications Power Supply

When sharing one power source with the communications power supply and I/O devices, provide respective power sources separately.

Separating power source prevents noise caused by I/O device operations from affecting communication.



Disconnect I/O devices from the communications power supply.

4.1.3.4 Broken Unit Examination (Dividing Network Examination)

When you cannot quickly find the trouble point due to a broken unit, connection failure including loose connector, or cable partial disconnection, divide the network to find the trouble point. Verify how error occurrence conditions change while taking the following countermeasures.

How to Examine

Divide the network to find which node is the cause of the problem.

Verify that a master can establish communications with the slaves even though one slave is separated from the network.

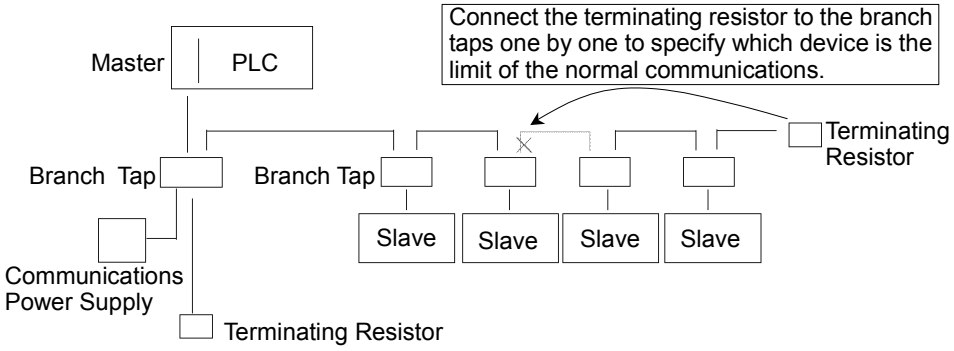
After finding the problem node, check the cables connected to it and replace the unit.

How to Divide

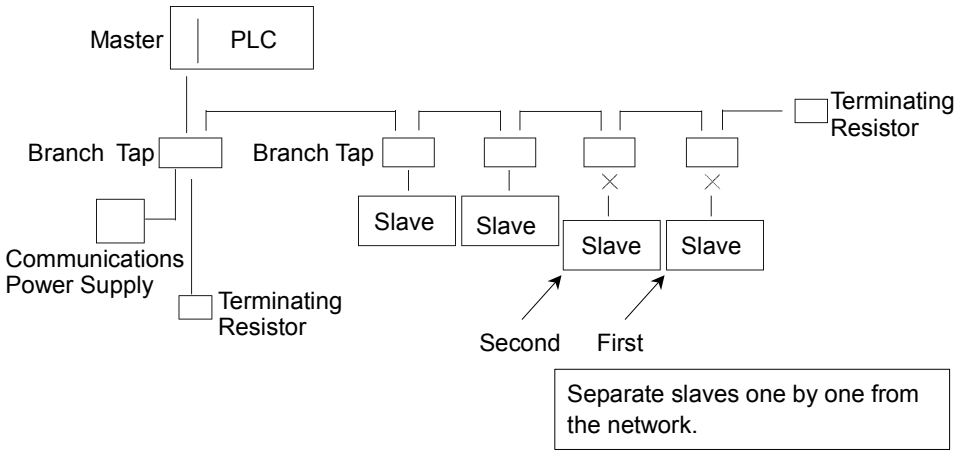
To divide the network, follow either procedure described below depending on the cable layout.

(1) Separating each block from the network
Divide the network by block and check each block.

1. Ensure that the master has no problem by connecting it to its slaves one by one. (MS/NS: green light ON)
2. Divide the network in the middle of it and check for the communication condition. (MS/NS: green light ON)
   Normal: The trouble point is on the other half of the network.
   Error: The trouble point is on the current half of the network.
   (Continue dividing the half of the network further to distinguish error part from normal part.)
3. Check for communication on the block to specify the trouble point.



(2) Separate each slave from the network
Check for each slave. The trouble point is where error condition changes into normal condition.



4.1.3.5 Network Configuration and Specifications

(1) Maximum Network Length and Drop Line Length
Check that the cables used on the network meet the following specifications.

Type	Baud Rate	Max. Network Length	Drop Line Length	Total Drop Line Length
Thick Cable	500 kbps	100 m	6 m	39 m
	250 kbps	250 m		78 m
	125 kbps	500 m		156 m
Thin Cable	500 kbps	100 m		39 m
	250 kbps	100 m		78 m
	125 kbps	100 m		156 m

(2) Terminating Resistor
Ensure that two terminating resistors are connected to both ends of the network (trunk line). The terminating resistor should be 121 Ω 1/4 W.

(3) Cable and Branch Tap
The cables and branch taps should meet the DeviceNet specifications.

(4) Communications Power Supply
The communications power supply should be dedicated to DeviceNet.
Do not share power source with the communications power supply and I/O device. *

* Noise due to load on/off may affect DeviceNet communications via the communications power supply.
(The noise causes remote I/O communication error, Busoff detection, and broken unit.)

4.1.3.6 EPSON RC+ Master Configuration

For details of EPSON RC+ master configuration, refer to the section *2.5 DeviceNet Board Installation*.

The following section describes the procedure for verifying the scanner board condition with applicomIO Console application.

4.1.3.6.1 Verifying applicomIO Console application condition

The status bar at the bottom of the window shows the applicomIO Console application status. The status bar varies as shown below:

Character: The address number of the scanner board is indicated with characters. When the character "F" appears, the flash memory on the board initialized the scanner board.

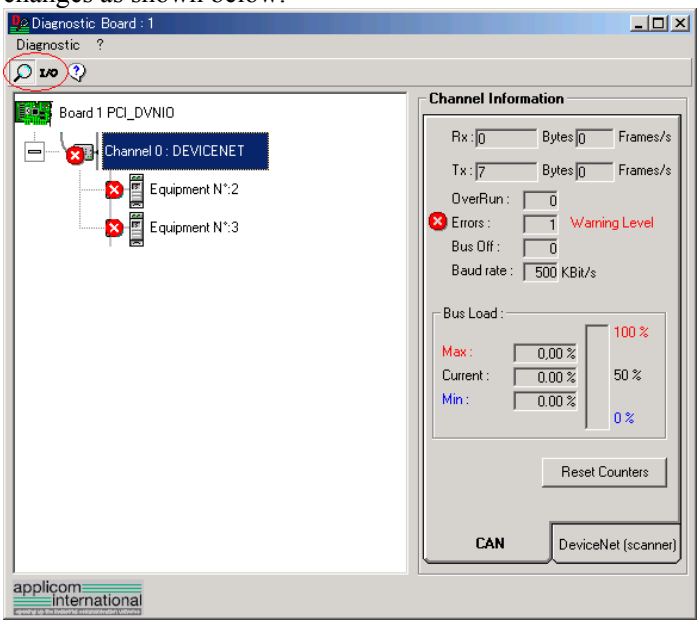
Background color: The background color indicates the scanner board status. For details, refer to the table below.

Background	Character	Status
Gray	Black	Access to scanner board was failed. After that, the status bar will not be renewed automatically. To renew the status bar, right-click the status bar and select **Refresh**.
Magenta	Black	The scanner board was initialized with an earlier version applicomIO Console application. It is recommended that the scanner board be written into the flash memory (reinitializing the scanner board) again with the current version applicomIO Console application.
Red	Black	The scanner board was not initialized. Initialize the scanner board to use it.
Yellow	Black	The scanner board was partially initialized. This status happens only during network detection and on-line actions.
Dark green	White	Although the scanner board was initialized, it is different than the currently opened configuration. (Different version, etc.) It is recommended that the scanner board be written into the flash memory (reinitializing the scanner board) again with the current version applicomIO Console application. This status happens only during network detection, on-line actions, and diagnostic.
Green	Black	The scanner board was initialized properly and it is no different with the currently opened configuration. This status happens only during network detection, on-line actions, and diagnostics.

4.1.3.6.2 Verifying the DeviceNet network condition

The applicomIO Console application has a network diagnostic function (Diagnostic). The procedure for using the Diagnostic is described below.

(1) Open the Diagnostic window, click the magnifying grass button, and select the "Channel" on the device tree in the left side of the window. The window changes as shown below.



The **CAN** and **DeviceNet (scanner)** tabs appear on the data display in the right side of the window.
The CAN controller status of the scanner board is displayed on the **CAN** tab.

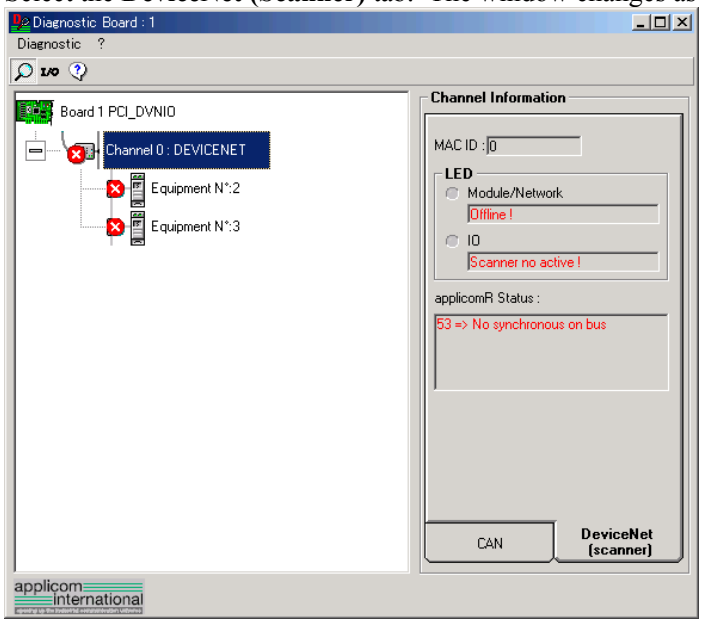
Rx	:	Number of receive data bytes and flames
Tx	:	Number of send data bytes and flames
OverRun	:	Number of communication overrun errors detected by CAN controller
Errors	:	Number of communication errors detected by CAN controller
Bus Off	:	Number of Busoff detections
Baud Rate	:	baud rate
Bus Load	:	Load on the bus (maximum, minimum, current)

NOTE

Use DeviceNet so that the load on a bus is under 60% of the maximum load. When the load exceeds 60%, the DeviceNet network communication will be unstable. (For example, more communication errors)

For the procedure for master configuration, refer to respective master device manuals. For EPSON RC+ master configuration, refer to the section *2.5.5 Master Mode*.

(2) Select the **DeviceNet (Scanner)** tab. The window changes as shown below.



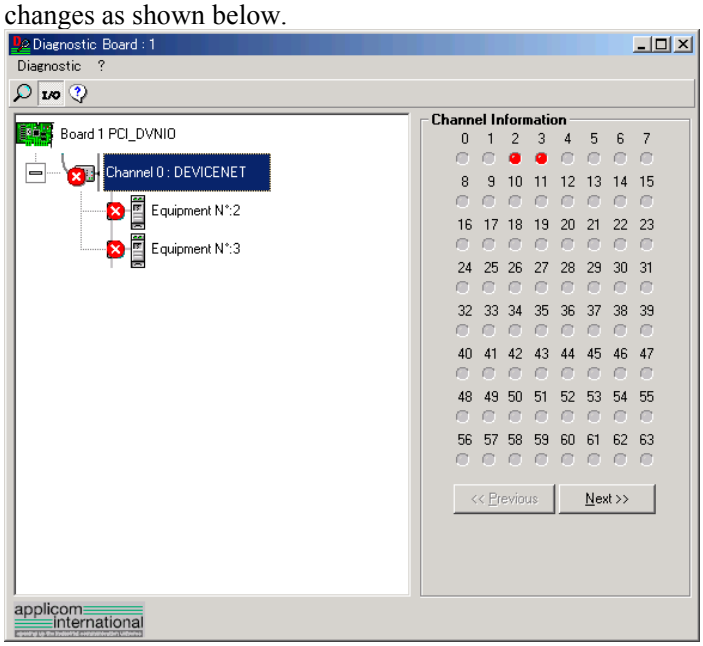
MAC ID : MAC ID specified for the scanner board
Module/NetWork LED : Network Status (NS) LED status
IO LED : Module Status (MS) LED status
applicomR Status : Scanner board status

The scanner board status is shown in the “Code No. => Comment” form. The code numbers are shown in the following table.

Status Code		Descriptions
General	Protocol	
0		No fault detected. The function was performed correctly.
	4	Inaccessible data. Additional information: The remote device is in error. Check its status.
32		Indicates that the parameters passed to the functions are not correct (eg: Number of requested variables too large)
	33	Response time-out fault. Additional information: The device does not answer. Check its status and the wiring. The DeviceNet master has no device to be scanned in its configuration.
	34	Physical defect on the line. Additional information: No +24V power supply was detected. The CAN component of the applicomIO® interface is "Bus Off". Check the network wiring and Baud Rate.
36		Device not configured. Define the device configuration with the applicomIO® Console and re-initiate the initialization of the applicomIO® product by running the PcInitIO

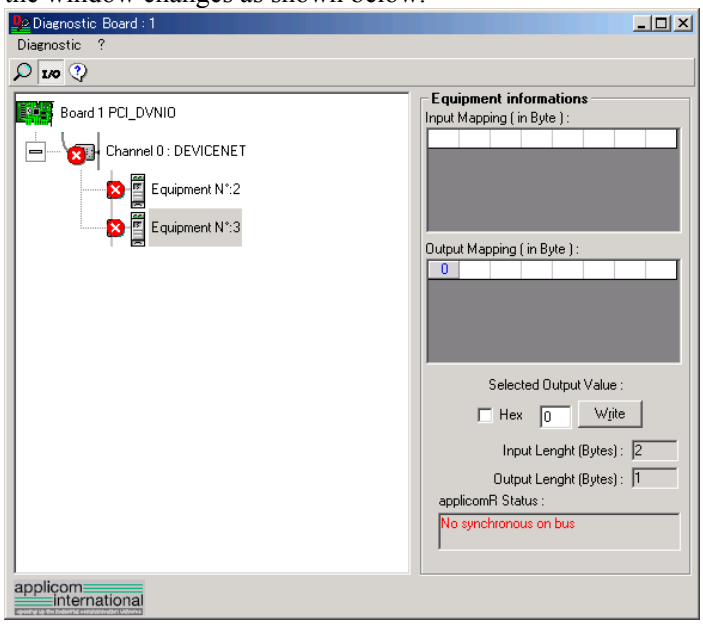
Status Code		Descriptions
General	Protocol	
45		Non-resident dialogue software. Additional information: Initialize the applicomIO® interface before use by running the PcInitIO
47		Targeted applicomIO® card invalid or incorrectly initialized by the function IO_Init
	53	Synchronization problem on the line. Additional information: The DeviceNet master is "off line" (power supply not detected or the CAN component of the applicomIO® is "Bus Off") Check the network wiring and Baud Rate.
	55	Response time-out exceeded. Additional information: The device accepted the connection but did not answer the request. Check the device status.
	65	Connection denied. Additional information: Connection to the DeviceNet master is in progress or refused by the device.
	70	Connection finished. Additional information: Duplication of MAC ID detected on the DeviceNet network. Modify the MAC ID of the DeviceNet master.
	79	Profile incompatible. Additional information: The device does not match the configuration. Check the device identity and the connection sizes.
63		Indicates that a communication error has been encountered on serial Port.
66		Not enough applicomIO® interface memory.
93		Driver cannot be accessed.
99		Indicates that applicomIO® solution is already running.
255		Indicates that the local input buffer was not updated beforehand by the function IO_RefreshInput.

(3) When you click the **I/O** button on the upper left of the window, the window changes as shown below.



Each slave device status is shown in the right side of the window.
A green circle indicates that the communication of the corresponding device is normal, and a red circle indicates that there is a communication error. A gray circle indicates that the corresponding device does not exist.

(4) When you select "Equipment" on the device tree in the left side of the window, the window changes as shown below.



The input and output statuses of the selected device are shown in the right side of the window.
If you want to change output data, click the byte number you want to change in the **Output Mapping** box. Then, enter a value in the **Write** box in the "Selected Output Value" and click the **Write** button.

4.2 PROFIBUS DP Troubleshooting

Exclusion

Every system has its special environment, conditions, specifications, and usages. This guide is provided as general reference for troubleshooting a PROFIBUS DP network. Every effort has been made to ensure the information is accurate. However, we do not guarantee the complete accuracy of the information and thus we decline any liability for damages or costs incurred by the use of this troubleshooting.

Before examining a problem on the network, please ensure that your established PROFIBUS DP system satisfies network specifications. (Refer to this troubleshooting and the section *2.4 PROFIBUS DP Network Construction*.)

Tools

Prepare the following tools for troubleshooting.

Philips screwdriver

Flat-blade screwdriver

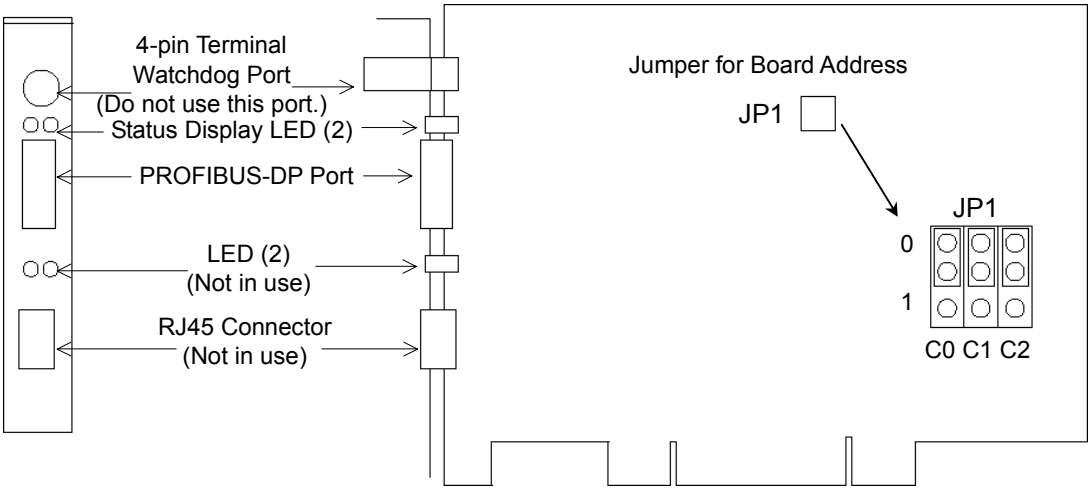
Tester

4.2.1 Examining a Problem

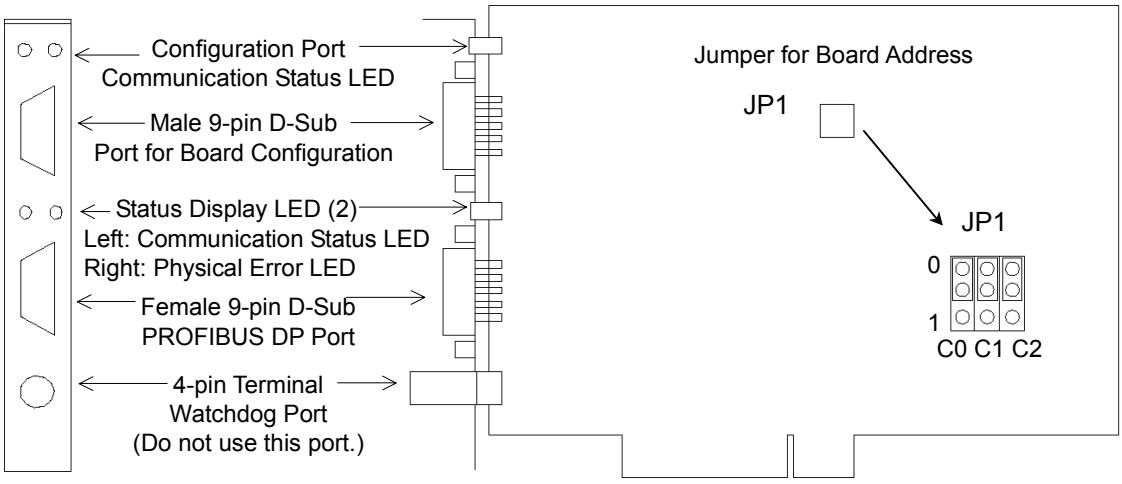
4.2.1.1 Scanner Board Diagnostic LEDs

The PROFIBUS DP board used with EPSON RC+ has two status display LEDs. The layout of the LEDs is shown in the following figure.

PCU-DPIO



PCI-DPIO



The Communication Status LED is on the left and the Physical Error LED is on the right seen from the rear panel.

The Communication Status LED is expressed by the ST LED (ST) in this section.

The Physical Error LED is expressed by the BF LED (BF) in this section.

4.2.1.2 Check Network Status

First of all, you should check the current condition of the network. There are different specifications of status display LED on a device in the PROFIBUS DP standard. This section explains how to check the network status assuming that EPSON RC+ is configured as a master or slave.

(1) Master Status: BF/ST LEDs

LED	Color		Light Condition		
BF (Physical error)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF
ST (Communication Status)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF

(2) Station Number of Absent Slaves

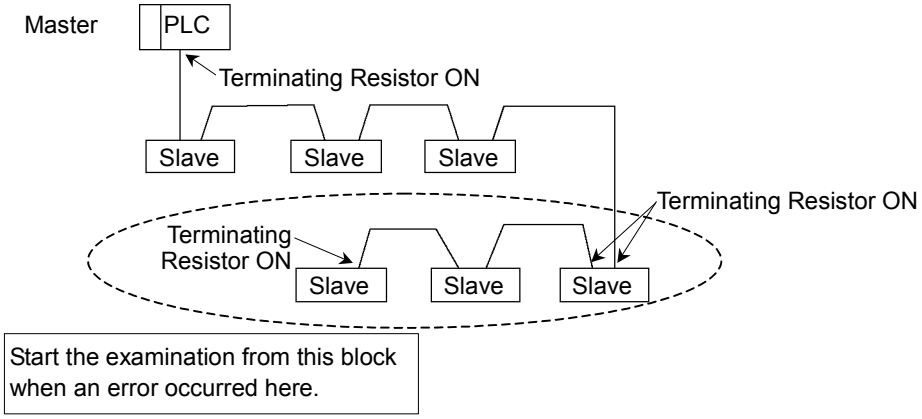
Absent slaves are disconnected from or not added to the network.

1. See the status flag regarding to the removal and addition if the master has status information.
2. See the BF/ST LEDs of all slaves if the master has no status information.

(3) Absent Slave Status: BF/ST LEDs

LED	Color		Light Condition		
BF (Physical error)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF
ST (Communication Status)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF

(4) Physical Node Location of Absent Slave



(5) Error Occurrence Condition

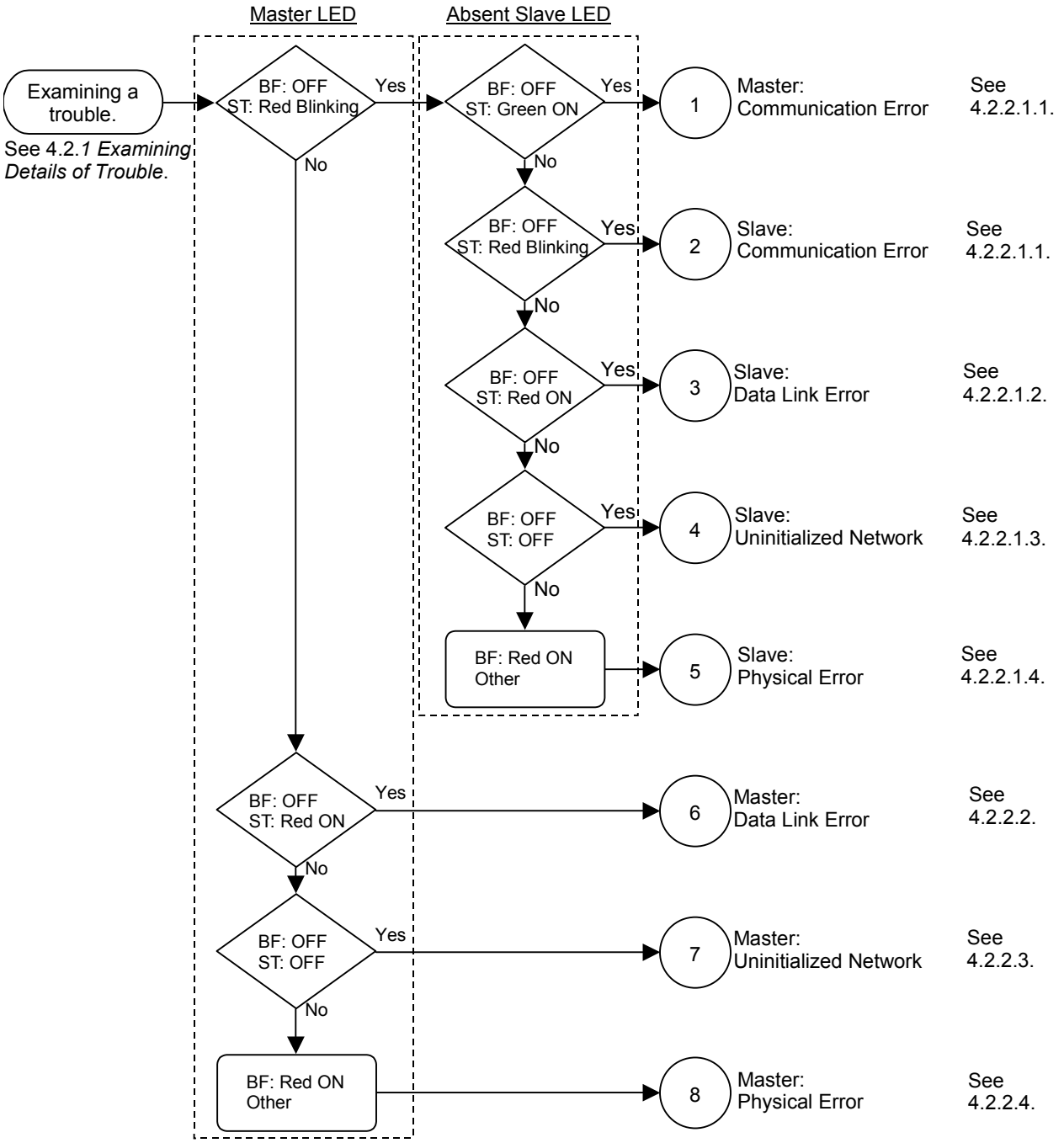
☐ Immediate occurrence (high reproducibility)

☐ Rare occurrence (low reproducibility)

4.2.2 Problems and Countermeasures

Master Unit LED		Error	Description [Reference]
BF	ST		
Light OFF	Green Light Blinking	Normal communication	- Normal condition
Light OFF	Green Light ON	Ready for communication	- Normal condition
Light OFF	Red Light Blinking	Communication error	[Refer to the section *4.2.2.1 Master Communication Error*.] - Slave disconnected from the network (Remote I/O communication error) - Slave not added to the network (Scan list collation error) - Nonstandard wiring - No or too many terminating resistors - Noise intrusion
Light OFF	Red Light ON	Data link layer error	[Refer to the section *4.2.2.2 Master: Data Link Layer Error*.] - Nonstandard wiring - Noise intrusion
Light OFF	Light OFF	Uninitialized network	[Refer to the section *4.2.2.3 Master: Uninitialized Network*.] - Master unit power error - Master unit configuration error
Red Light ON	No Matter	Physical error	[Refer to the section *4.2.2.4 Master: Configuration Error*.] - Nonstandard wiring - Signal wire connection failure - Signal wire short circuit

♦ Process Flowchart



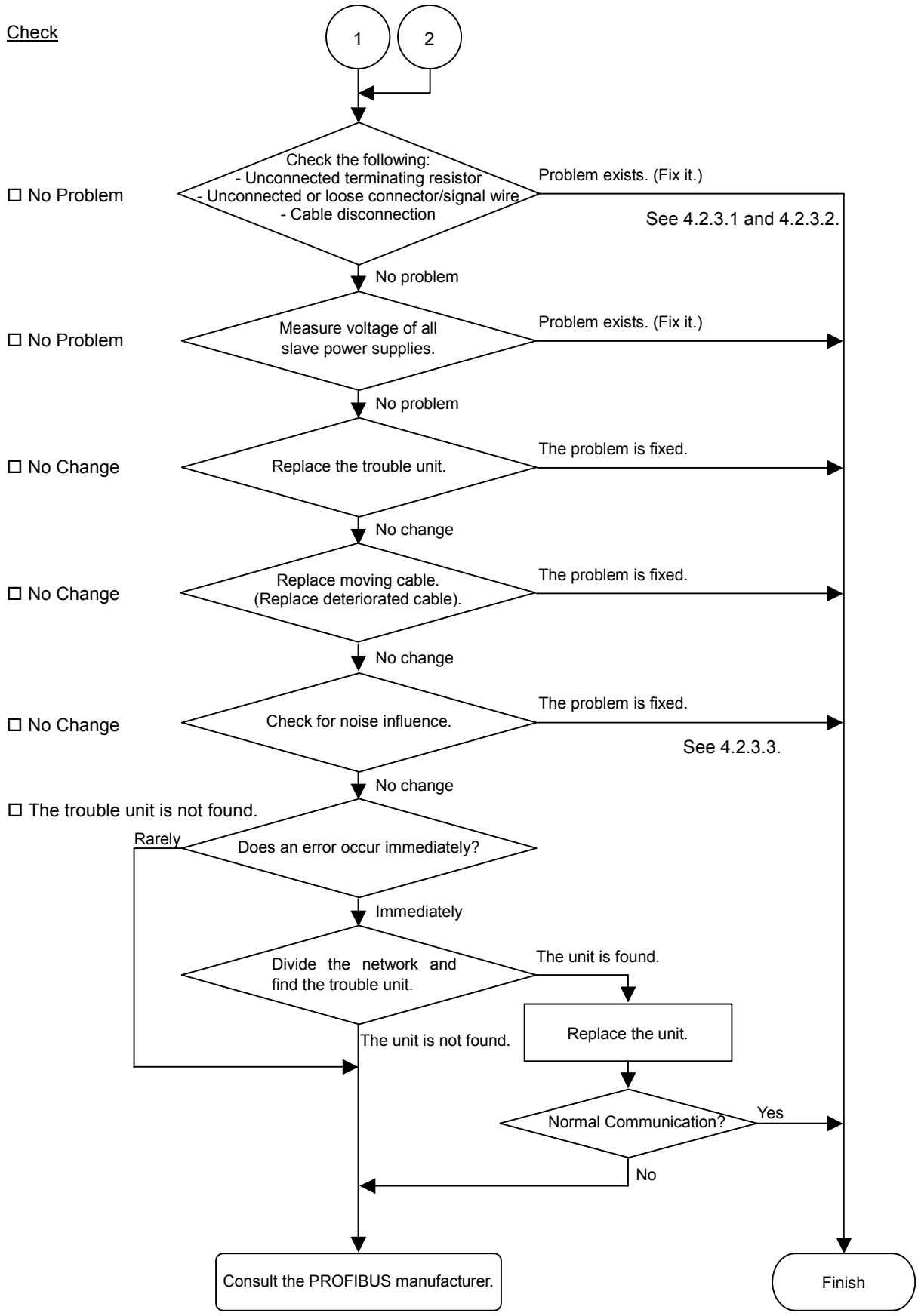
4.2.2.1 Master: Communication Error

Master Unit LED		Error	Description
BF	ST		
Light OFF	Red Light Blinking	Communication error	- Slave disconnected from the network (Remote I/O communication error) - Slave not added to the network (Scan list collation error) - Nonstandard wiring - No or too many terminating resistors - Noise intrusion

4.2.2.1.1 Master/Slave: Communication Error

	BF	ST
Master LED Condition	Light OFF	Red Light Blinking
Absent Slave LED Condition (Communication error)	Light OFF	Green Light Blinking
	Light OFF	Red Light Blinking

♦ Process Flowchart



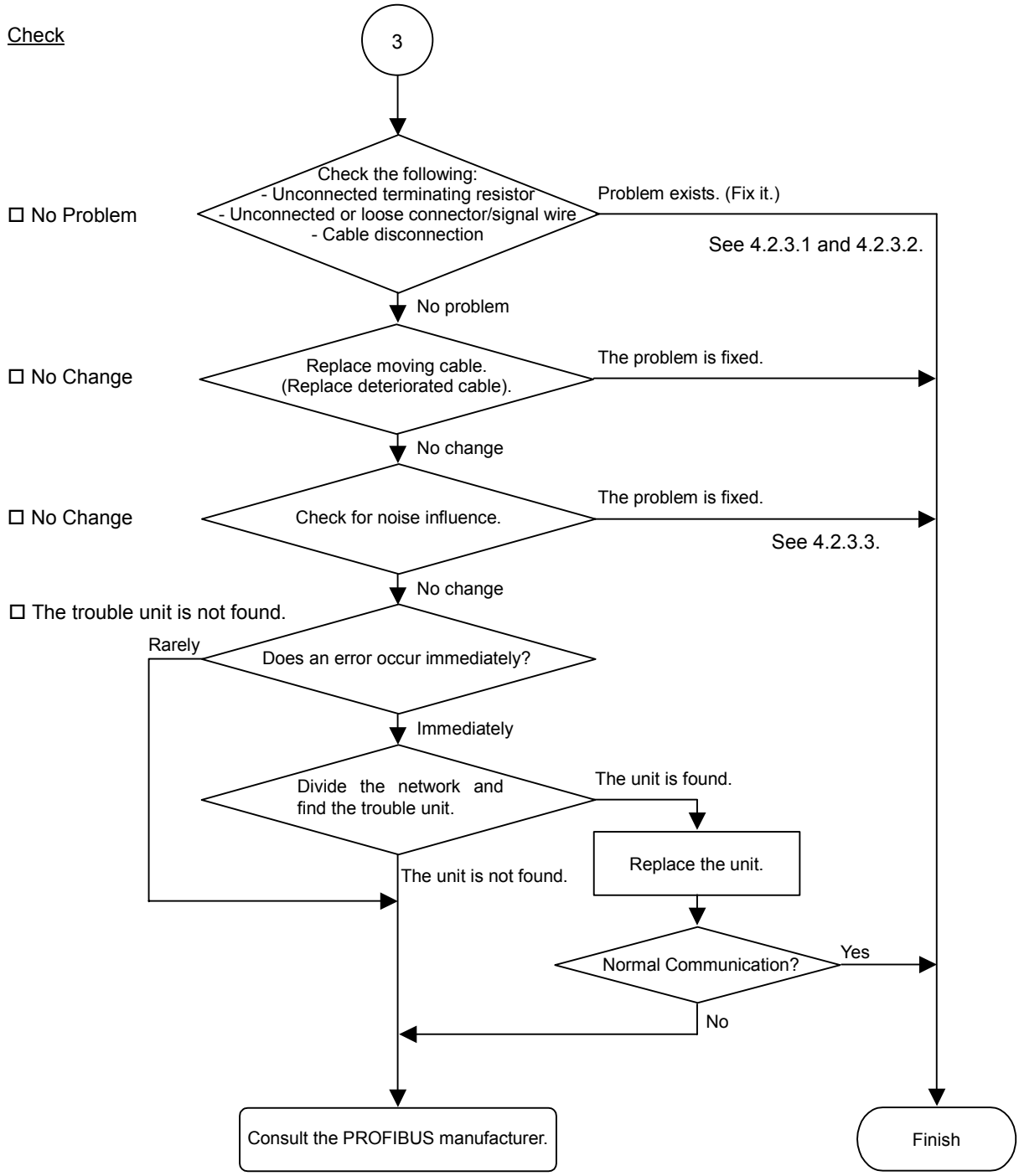
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with device power supply OFF. → Normal: 100 to 120 Ω ● Measuring point: Connection of the trouble unit ● For detail, refer to the section *4.2.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 220 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: all stations and all branch taps ● For details, refer to the section *4.2.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ Electrical surges of device power supply	Measure voltage of device power supply at the trouble unit. → It should be within the range of sufficient voltage for device operation.	Check voltage of the device power supply.
○ Noise (external cause)	Check the noise intrusion via the following paths (1) to (3). (1) Noise via shield (2) Induced noise via communication cable (3) Device power supply → For details, refer to the section *4.2.3.3 Noise Intrusion*.	Take countermeasures against noise.
○ Broken unit	Replace the trouble unit with a new one. → Verify whether the problem is fixed.	Replace the unit with a new one.
● No cause is identified.	Identify the trouble point by dividing the network. → For details, refer to the section *4.2.3.4 Broken Unit Examination*.	

4.2.2.1.2 Slave: Data Link Error

	MS	NS
Master LED Condition	Light OFF	Red Light Blinking
Absent Slave LED Condition (Data link error)	Light OFF	Red Light ON

♦ Process Flowchart



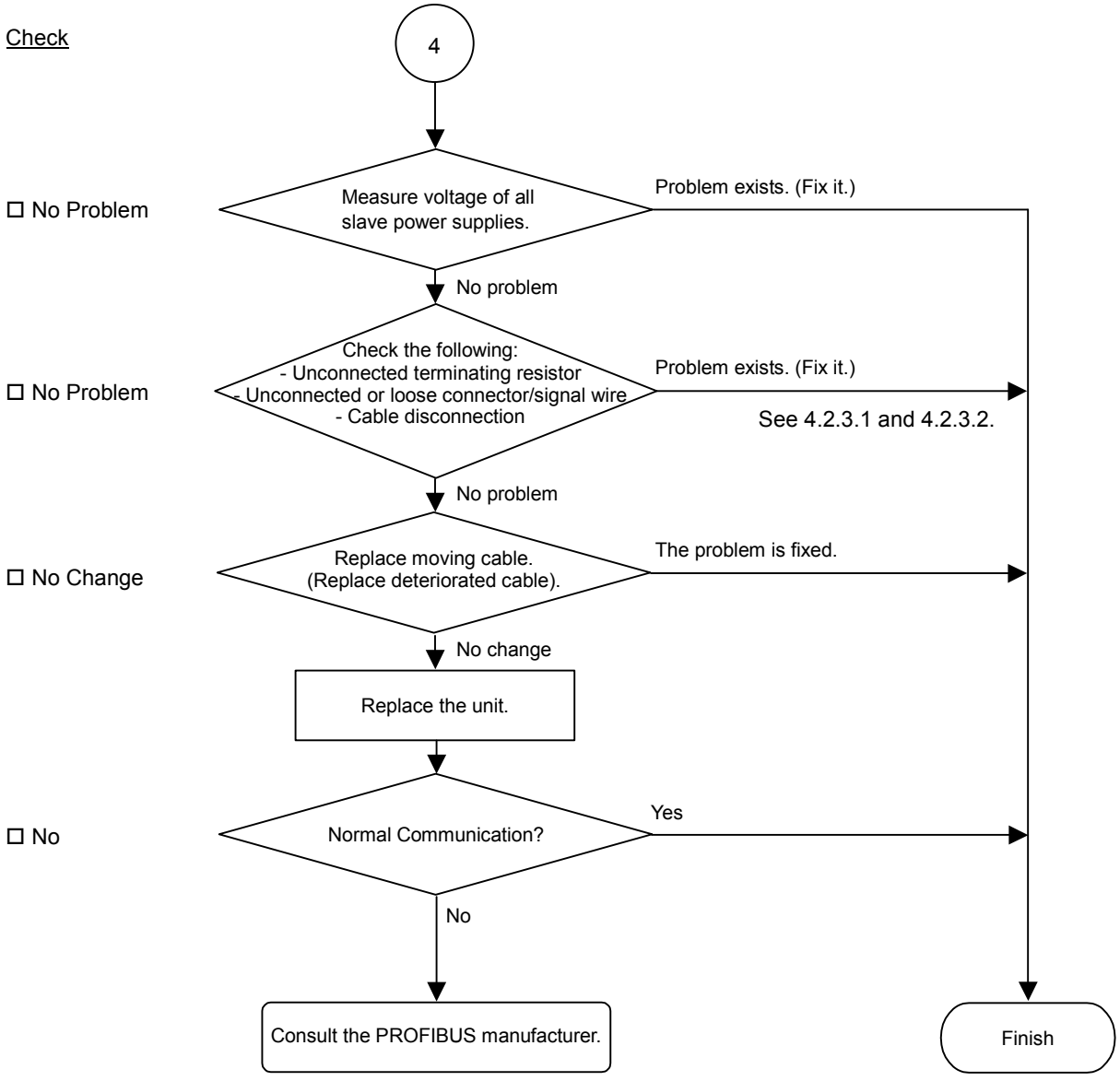
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with device power supply OFF. → Normal: 100 to 120 Ω ● Measuring point: Connection of the trouble unit ● For detail, refer to the section *4.2.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 220 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: all stations and all branch taps ● For details, refer to the section *4.2.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ Noise (external cause)	Check the noise intrusion via the following paths (1) to (3). (1) Noise via shield (2) Induced noise via communication cable (3) Device power supply → For details, refer to the section *4.2.3.3 Noise Intrusion*.	Take countermeasures against noise.
○ Broken unit	Replace the trouble unit with a new one. → Verify whether the problem is fixed.	Replace the unit with a new one.
● No cause is identified.	Identify the trouble point by dividing the network. → For details, refer to the section *4.2.3.4 Broken Unit Examination*.	

4.2.2.1.3 Slave: Uninitialized Network

	BF	ST
Master LED Condition	Light OFF	Red Light Blinking
Absent Slave LED Condition (Uninitialized Network)	Light OFF	Light OFF

♦ Process Flowchart



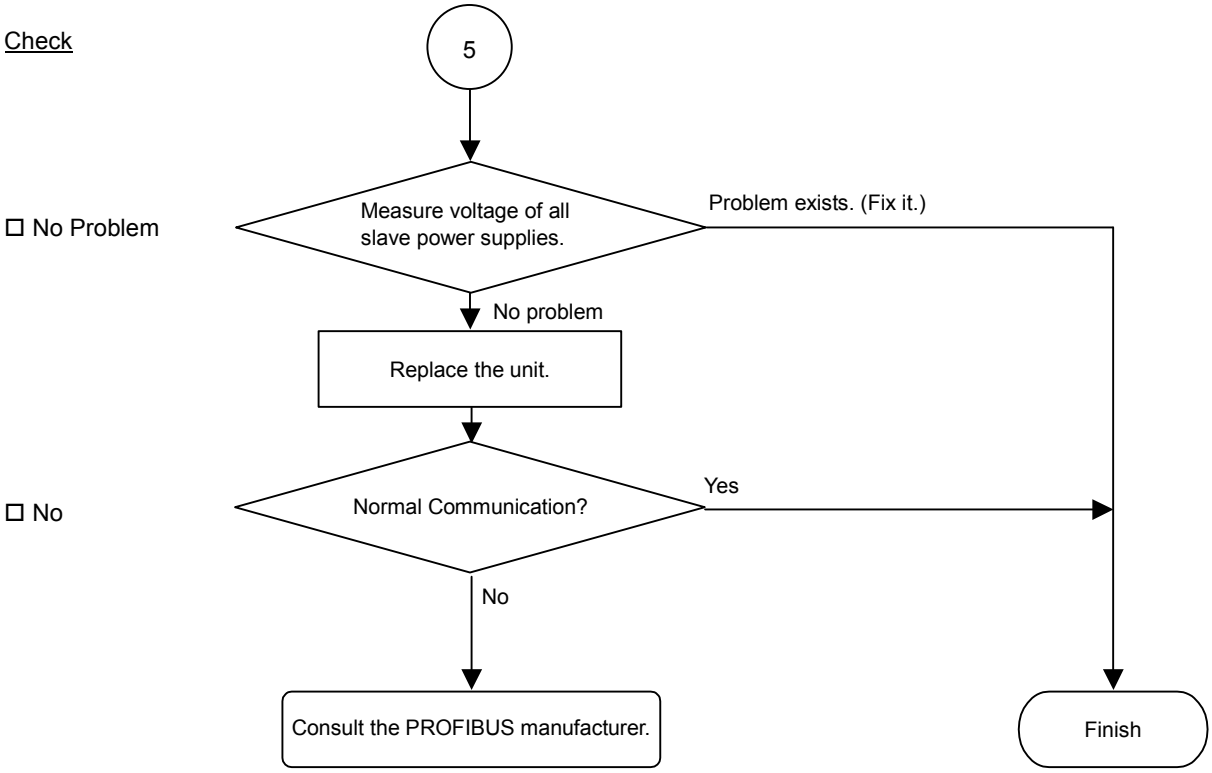
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Electrical surges of device power supply	Measure voltage of device power supply at the trouble unit. → It should be within the range of sufficient voltage for device operation.	Check voltage of the device power supply.
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with device power supply OFF. → Normal: 100 to 120 Ω ● Measuring point: Connection of the trouble unit ● For detail, refer to the section *4.2.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 220 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: all stations and all branch taps ● For details, refer to the section *4.2.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ Broken unit	Replace the trouble unit with a new one. → Verify whether the problem is fixed.	Replace the unit with a new one.

4.2.2.1.4 Slave: Physical Error

	BF	ST
Master LED Condition	Light OFF	Red Light Blinking
Absent Slave LED Condition (Physical error)	Red Light ON	No Matter

♦ Process Flowchart



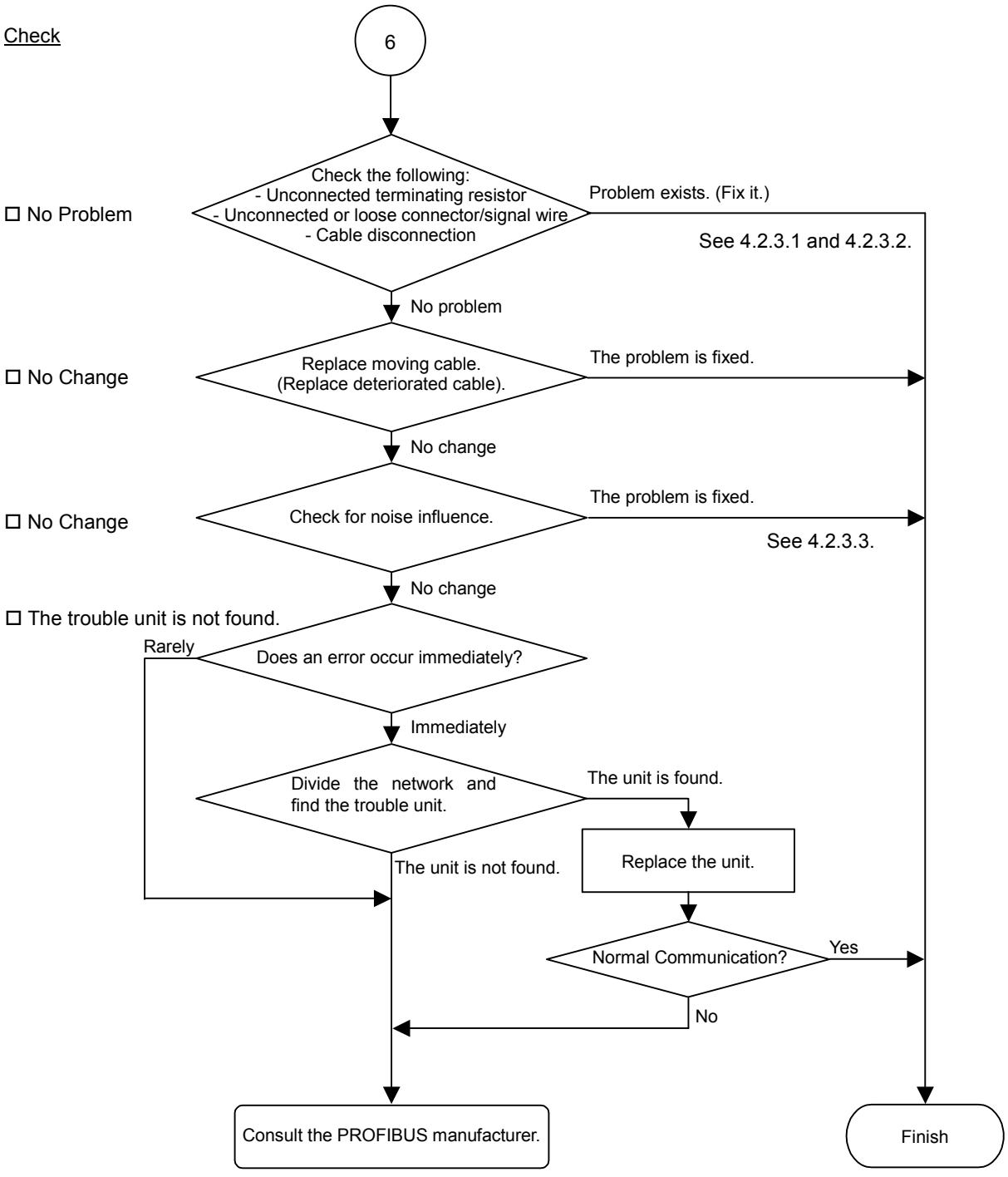
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Electrical surges of device power supply	Measure voltage of device power supply at the trouble unit. → It should be within the range of sufficient voltage for device operation.	Check voltage of the device power supply.
○ Broken unit	Replace the trouble unit with a new one. → Verify whether the problem is fixed.	Replace the unit with a new one.

4.2.2.2 Master: Data Link Layer Error

Master Unit LED		Error	Description
BF	ST		
Light OFF	Red Light ON	Data link layer error	- Nonstandard wiring - Noise intrusion

♦ Process Flowchart



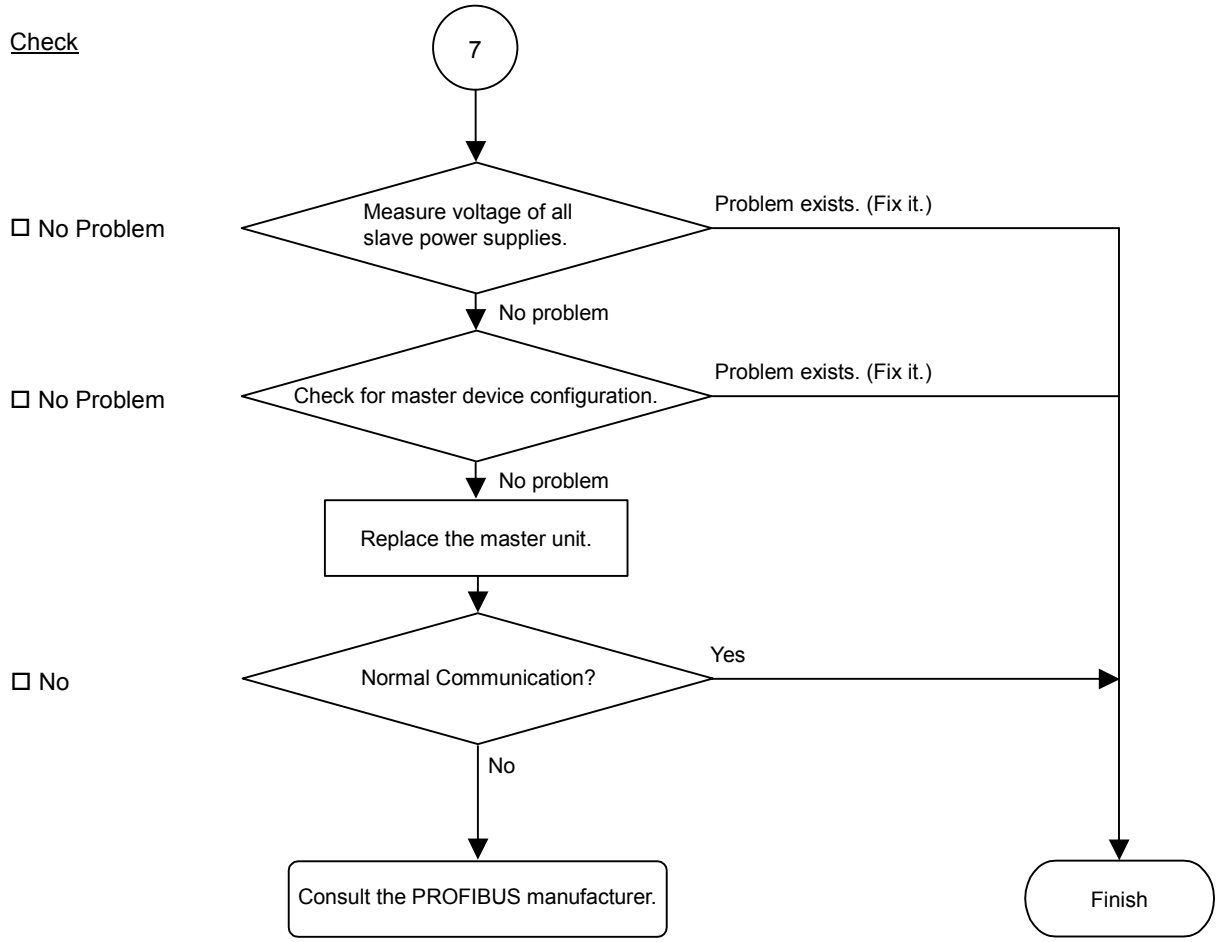
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with device power supply OFF. → Normal: 100 to 120 Ω ● Measuring point: Connection of the trouble unit ● For detail, refer to the section *4.2.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 220 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: all stations and all branch taps ● For details, refer to the section *4.2.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ Noise (external cause)	Check the noise intrusion via the following paths (1) to (3). (1) Noise via shield (2) Induced noise via communication cable (3) Device power supply → For details, refer to the section *4.2.3.3 Noise Intrusion*.	Take countermeasures against noise.
○ Broken unit	Replace the trouble unit with a new one. → Verify whether the problem is fixed.	Replace the unit with a new one.
● No cause is identified.	Identify the trouble point by dividing the network. → For details, refer to the section *4.2.3.4 Broken Unit Examination*.	

4.2.2.3 Master: Uninitialized Network

Master Unit LED		Error	Description
BF	ST		
Light OFF	Light OFF	Uninitialized network	- Master unit power error - Master unit configuration error

♦ Process Flowchart



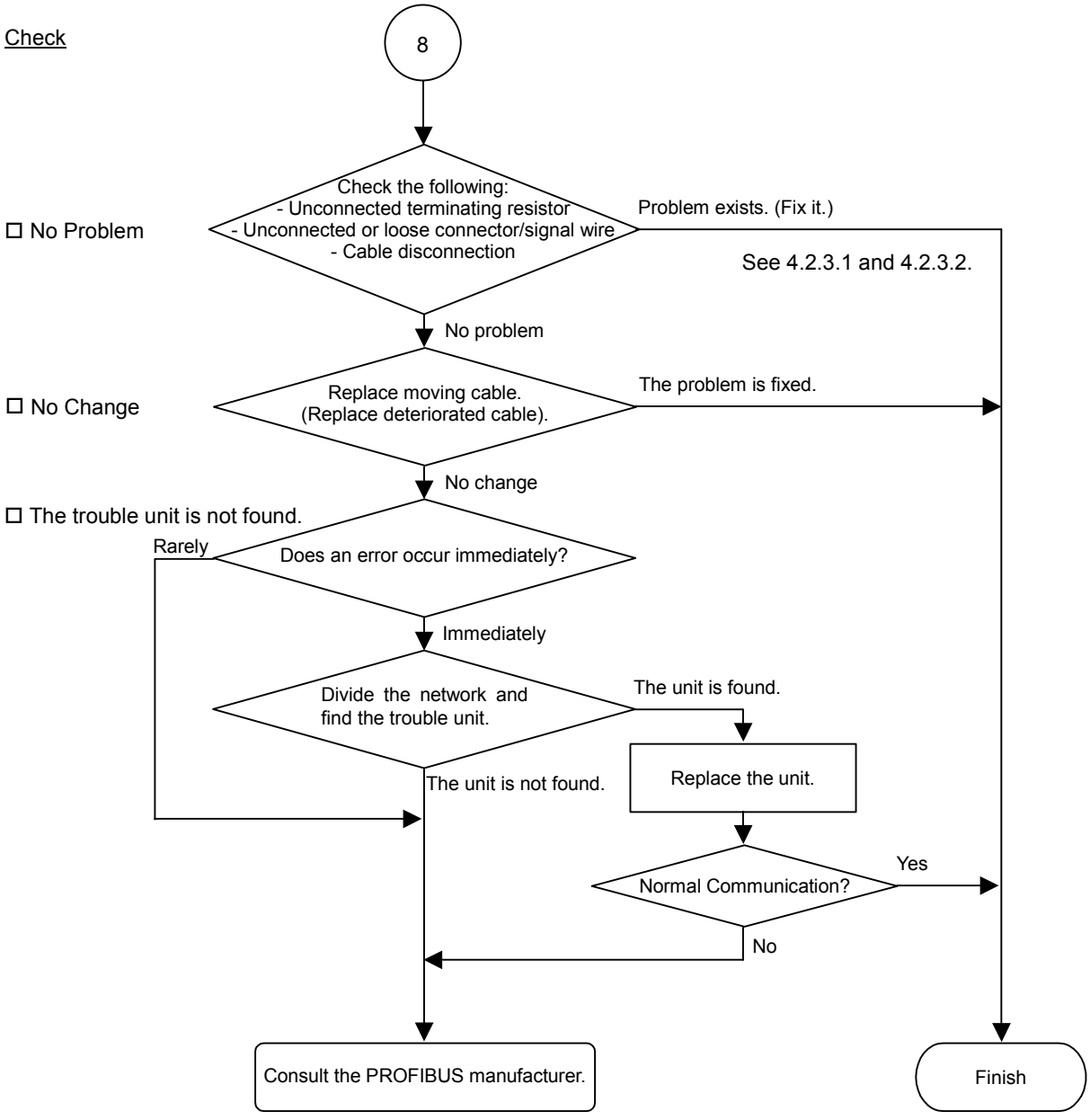
♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Electrical surges of master device power supply	Measure voltage of device power supply at the master unit. → It should be within the range of sufficient voltage for device operation.	Check voltage of the device power supply.
○ Master device configuration error	Check that the master device was configured properly. → After changing the configuration, verify whether the problem is fixed.	Check the master unit configuration.
○ Broken master unit	Replace the broken master unit with a new one. → Verify whether the problem is fixed.	Replace the master unit with a new one.

4.2.2.4 Master: Configuration Error

Master Unit LED		Error	Description
BF	ST		
Red Light ON	No Matter	Physical error	- Nonstandard wiring - Signal wire connection failure - Signal wire short circuit

♦ Process Flowchart



♦ Causes of Error

Possible Cause	Examination Method	Countermeasure
○ Disconnected terminating resistors ○ Cable disconnection ○ Disconnected connector ○ Disconnected signal wire	(1) Check that terminating resistors are connected to both ends of the network. (2) Measure resistance between signal wires with device power supply OFF. → Normal: 100 to 120 Ω ● Measuring point: Connection of the trouble unit ● For detail, refer to the section *4.2.3.1 Connection Problem*.	Fix the problem. How to find the trouble point: Remove the terminating resistor on one end of the network. The trouble point is where resistance changes from 220 Ω.
○ Loose connector ○ Loose signal wire	Check for the connection of connectors and signal wires. → The connectors and signal wires should be firmly connected. ● Checkpoint: all stations and all branch taps ● For details, refer to the section *4.2.3.2 Loose Connector and Signal Wire*.	Connect the connectors and signal wires again.
○ Broken unit	Replace the trouble unit with a new one. → Verify whether the problem is fixed.	Replace the unit with a new one.
● No cause is identified.	Identify the trouble point by dividing the network. → For details, refer to the section *4.2.3.4 Broken Unit Examination*.	

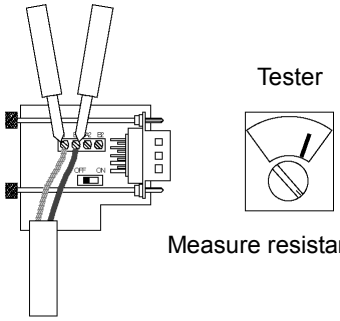
4.2.3 Procedures for Examining Possible Causes

4.2.3.1 Connection Problem (Disconnected Terminating Resistors, Cable Disconnection, Disconnected Connector, Disconnected Signal Wire)

(1) Ensure that two terminating resistors are connected to both ends of the network.

(2) Turn OFF all device power supplies.

(3) Measure resistance between A1 and B1 wires of the absent slave using the tester.

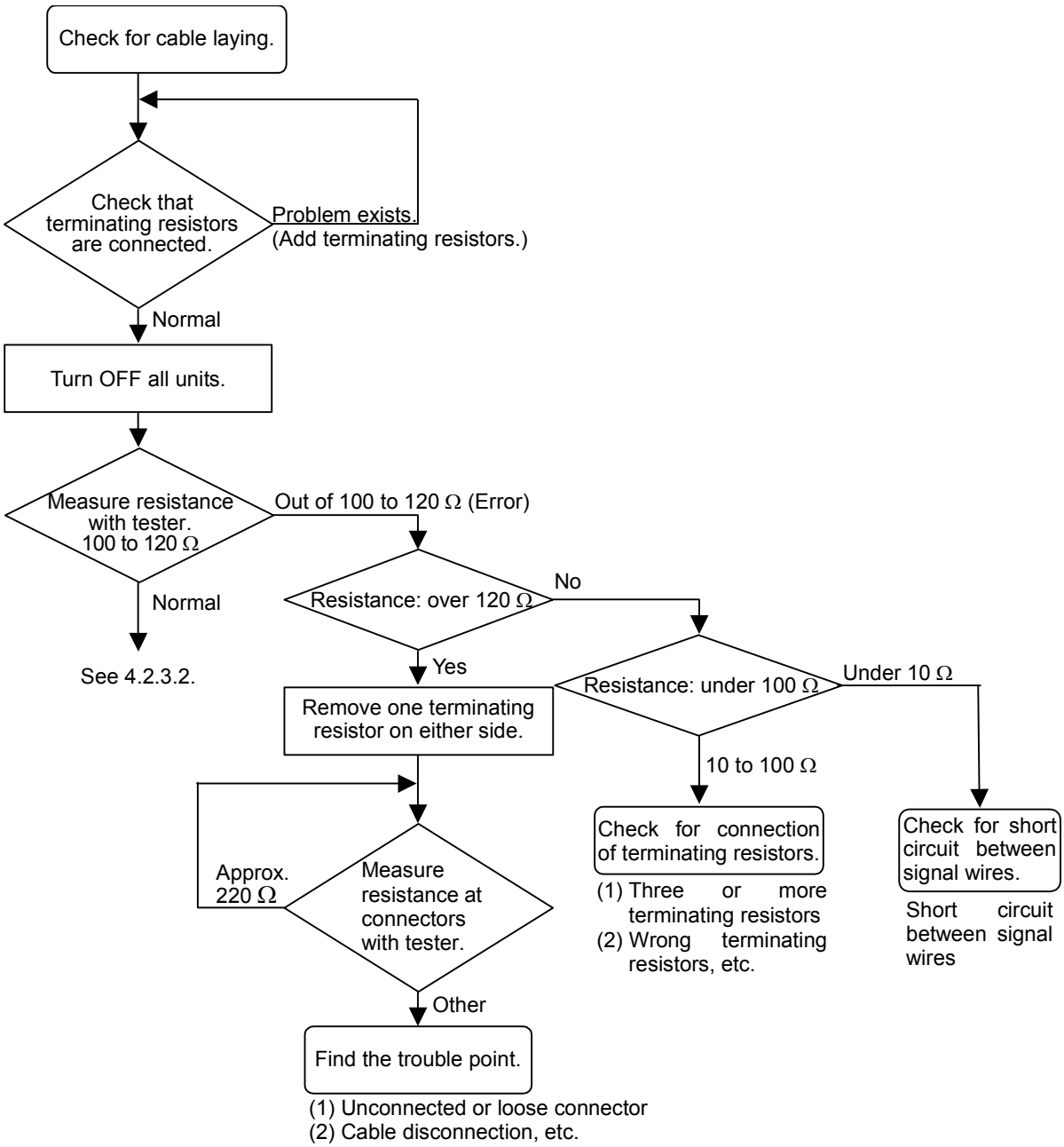


Resistance	Determination
0 Ω	Shot circuit
Under 100 Ω	Three or more terminating resistors on one network
100 to 120 Ω	Normal
Over 120 Ω	Error (cable disconnection, disconnected signal wire, one or zero terminating resistor)

(4) How to find the trouble point:

- Remove the terminating resistor on one end of the network.
  (The resistance at the point where the terminating resistor is connected is 220 Ω.)
- Measure resistance at branch taps of all units.
- The trouble point is where resistance changes from 220 Ω.
- After finding the trouble point, verify the connector and cable conditions.

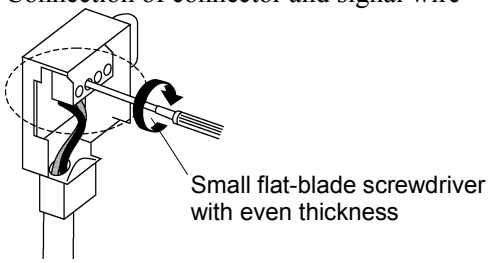
♦ Process Flowchart



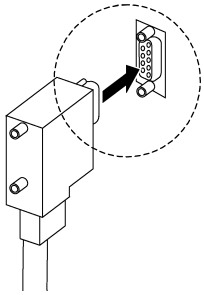
4.2.3.2 Loose Connector and Signal Wire

Check for the connections of the following parts on the connector and cable.

(1) Connection of connector and signal wire



(2) Connection of connector and unit

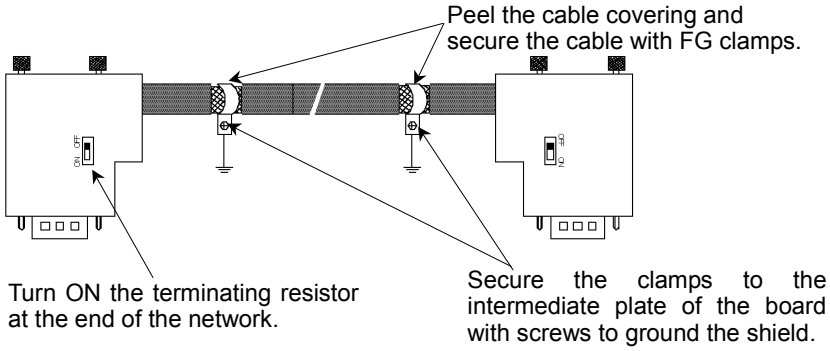


4.2.3.3 Noise Intrusion

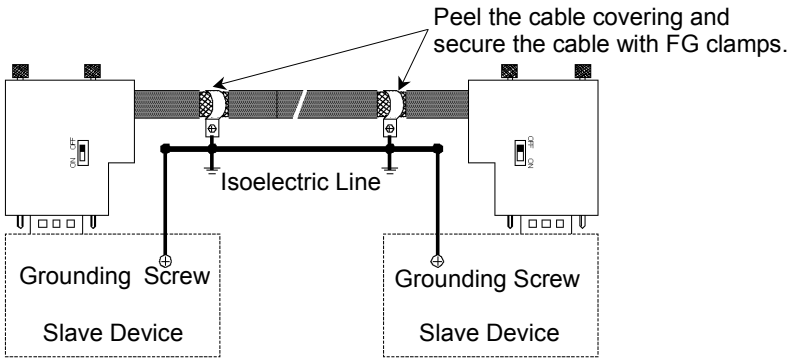
Verify how error occurrence condition changes while taking the following countermeasures.

♦ Ground of FG wire

Normal Grounding: Peel the cable covering and ground the FG wire.

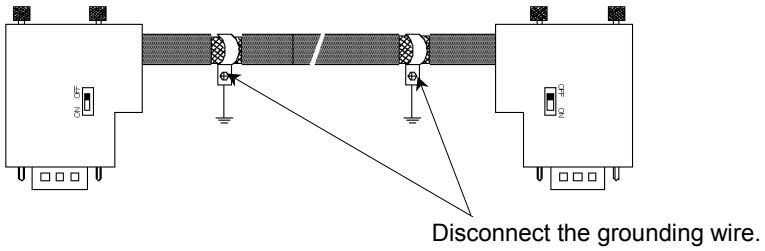


Countermeasure 1: Improve FG.



Countermeasure 2: Disconnect the FG wire to isolate it from the ground.

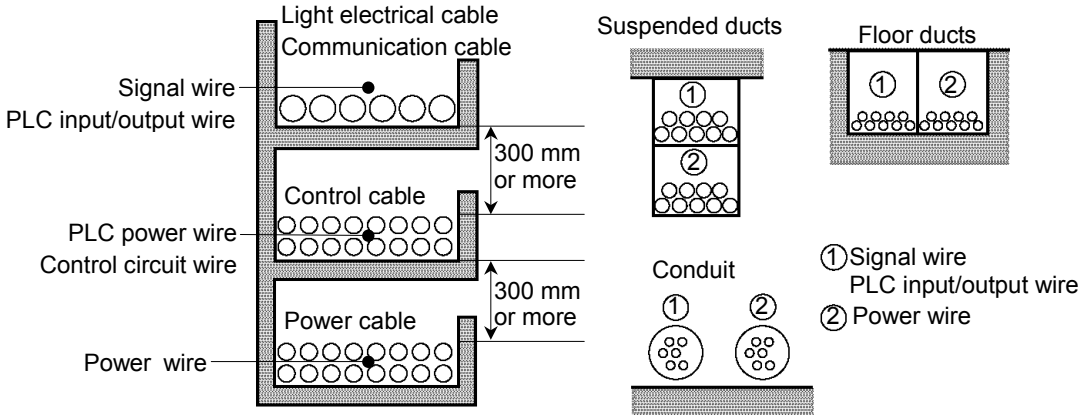
When noise intrudes the ground line because a noise source such as an inverter is installed near the grounding point, disconnect the shield wire of the signal cable and isolate it from the ground to restrain noise intrusion.



♦ Induced noise via communication cable

Separate the PROFIBUS DP signal wire from the other wires (especially power wires).

* Separate the signal wire from the power wires 300 mm or more.



During site inspection, bypass the wire that is possibly affected by induced noise with other cables and then lay the cables. Establish the communication under no induced noise condition and verify whether an error occurs.

4.2.3.4 Broken Unit Examination (Dividing Network Examination)

When you cannot quickly find the trouble point due to broken unit, connection failure including loose connector, or cable partial disconnection, divide the network to find the trouble point. Verify how error occurrence conditions change while taking the following countermeasures.

How to Examine

Divide the network to find which station is a cause of a trouble.

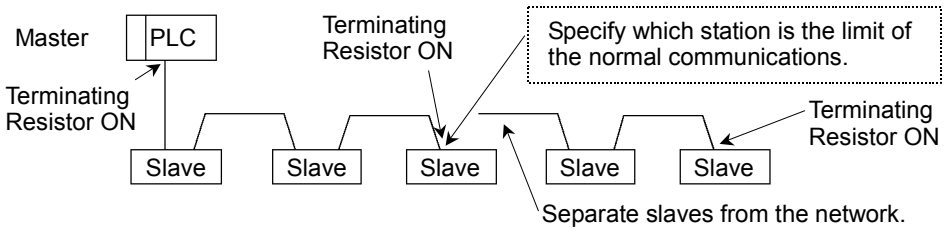
Verify that a master can establish communications with the slaves even though one slave is separated from the network.

After finding the trouble station, check the cables connected to it and replace the unit.

How to Divide

Divide the network by block and check each block.

1. Ensure that the master has no problem by connecting it to its slaves one by one. (BF/ST: light OFF/green light ON or blinking)
2. Divide the network in the middle of it and check for the communication condition. (BF/ST: light OFF/green light ON or blinking)
   Normal: The trouble point is on the other half of the network.
   Error: The trouble point is on the current half of the network.
   (Continue dividing the half of the network further to distinguish error part from normal part.)
3. Check for communication on the block to specify the trouble point.

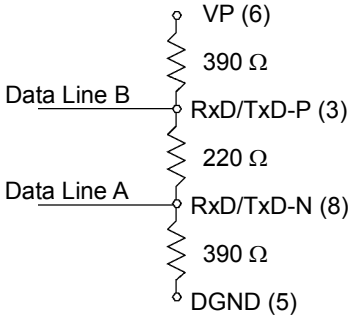


4.2.3.5 Network Configuration and Specifications

(1) Maximum Cable Length
Check that the cables used on the network meet the following specifications.

Baud Rates	Max. Cable Length
12 Mbps	100 m
6 Mbps	100 m
3 Mbps	100 m
1500 kbps	200 m
500 kbps	400 m
187.5 kbps	1000 m
93.75 kbps	1200 m
19.2 kbps	1200 m
9.6 kbps	1200 m

(2) Terminating Resistor
Ensure that two terminating resistors are connected to both ends of the network.
The terminating resistor should be connected as shown below.



(3) Cable
The cables should meet the PROFIBUS specifications.

Item	Property
Impedance	135 to 165 Ω
Capacity	< 30 pf/m
Loop resistance	110 Ω/km
Wire diameter	0.64 mm
Core cross-section	> 0.34mm^2

4.2.3.6 EPSON RC+ Master Configuration

For details of EPSON RC+ master configuration, refer to the section *2.6 PROFIBUS DP Board Installation*.

The following section describes the procedure for verifying the scanner board condition with the applicomIO Console application.

4.2.3.6.1 Verifying applicomIO Console application condition

The status bar at the bottom of the window shows the applicomIO Console application status. The status bar varies as shown below:

Character: The address number of the scanner board is indicated with characters. When the character "F" appears, the flash memory on the board initialized the scanner board.

Background color: The background color indicates the scanner board status. For details, refer to the table below.

Background	Character	Status
Gray	Black	Access to scanner board was failed. After that, the status bar will not be renewed automatically. To renew the status bar, right-click the status bar and select **Refresh**.
Magenta	Black	The scanner board was initialized with the earlier version applicomIO Console application. It is recommended that the scanner board be written into the flash memory (reinitializing the scanner board) again with the current version applicomIO Console application.
Red	Black	The scanner board was not initialized. Initialize the scanner board to use it.
Yellow	Black	The scanner board was partially initialized. This status happens only during network detection and on-line actions.
Deep green	White	Although the scanner board was initialized, it is different with the currently opened configuration. (Different version, etc.) It is recommended that the scanner board be written into the flash memory (reinitializing the scanner board) again with the current version applicomIO Console application. This status happens only during network detection, on-line actions, and diagnostic.
Green	Black	The scanner board was initialized properly and it is no different with the currently opened configuration. This status happens only during network detection, on-line actions, and diagnostic.

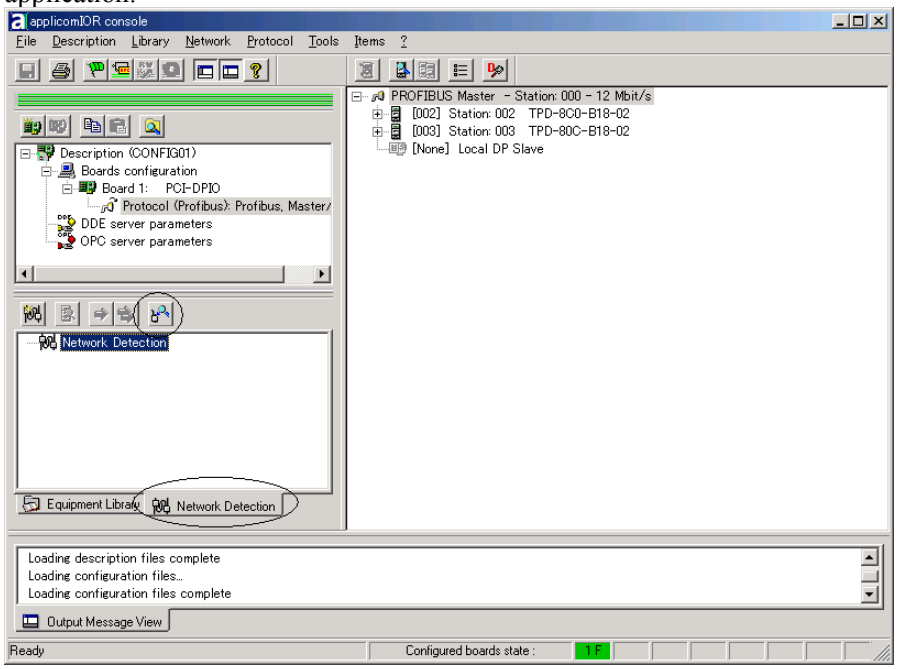
4.2.3.6.2 Verifying the PROFIBUS DP network condition

The applicomIO Console application has the following functions:

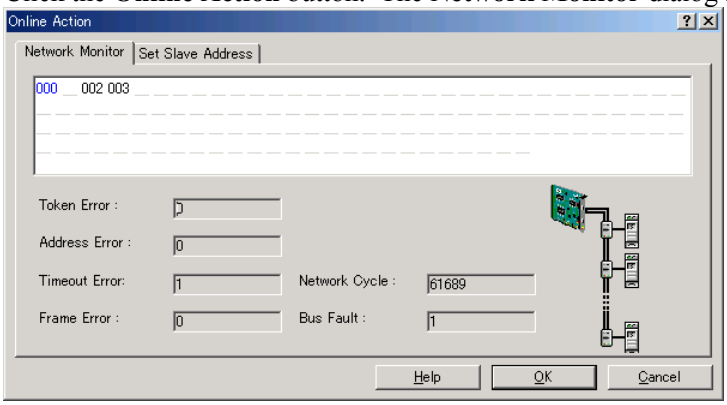
Network Monitor function: Monitoring error condition detected on the network

Diagnostic function: Network diagnosis

(1) Select the **Network Detection** tab in the left center of the applicomIO Console application.



(2) Click the **Online Action** button. The **Network Monitor** dialog appears.

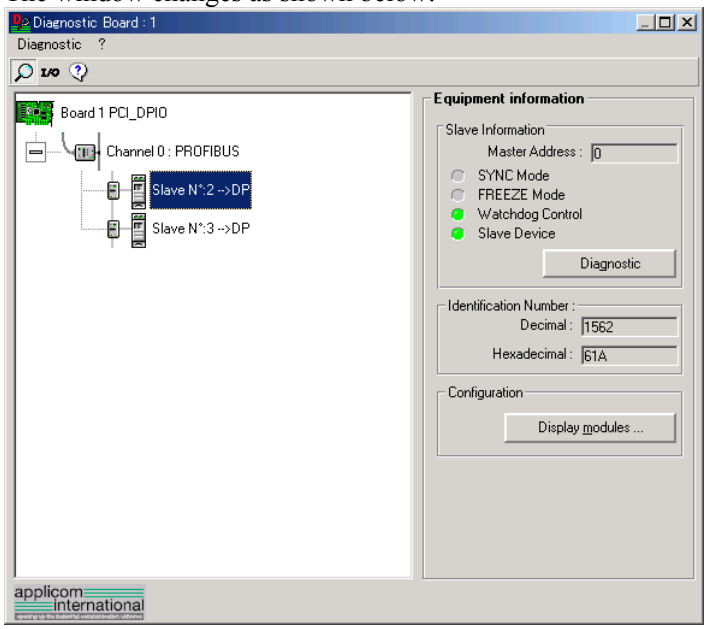


You can check the conditions of the following errors on this dialog.

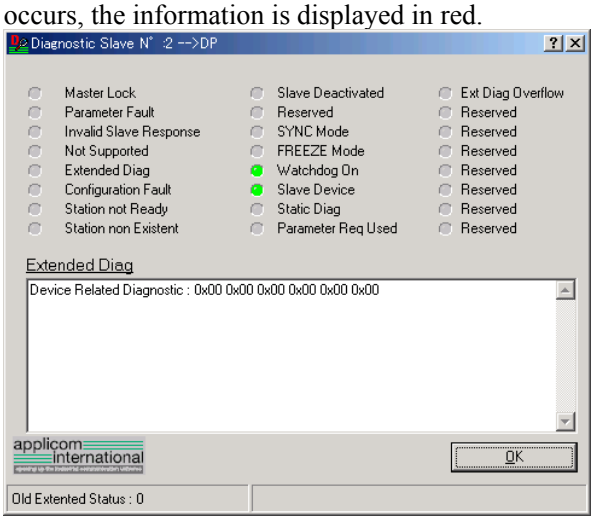
Token Error	Address Error	Timeout Error
Frame Error	Network Cycle	Bus Fault

When an error occurs on the network, it is added to the corresponding error counter.

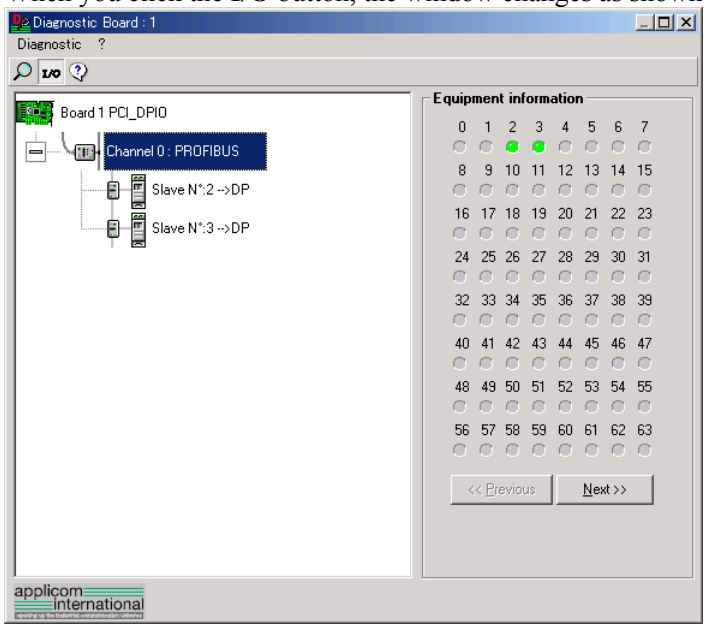
(3) Select the **Protocol** | **Diagnostic** on the applicomIO Console application menu. Click the magnifying grass button on the **Diagnostic** window.
Then, select the slave you want on the device tree in the left side of the window. The window changes as shown below.



To check the device condition in detail, click the **Diagnostic** button in the Equipment information group box in the right side of the window. If an error occurs, the information is displayed in red.

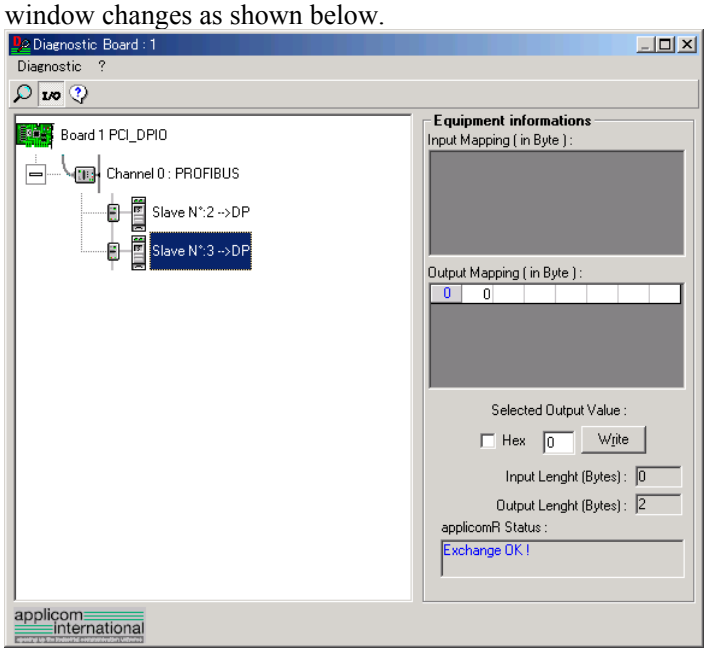


(4) When you click the **I/O** button, the window changes as shown below.



The status of each slave device is shown in the right side of the window.
A green circle indicates that the communication of the corresponding device is normal, and a red circle indicates that there is a communication error. A gray circle indicates that the corresponding device does not exist.

(5) When you select the slave on the device tree in the left side of the window, the window changes as shown below.



The input and output statuses of the selected device are shown in the right side of the window.
If you want to change output data, click the bite number you want to change in the **Output Mapping** box. Then, enter a value in the **Write** box in the "Selected Output Value" and click the **Write** button.

4.3 EtherNet/IP Troubleshooting

Exclusion

Every system has its special environment, conditions, specifications, and usages. This guide is provided as a general reference for troubleshooting a EtherNet/IP network. Every effort has been made to ensure the information is accurate. However, we do not guarantee the complete accuracy of the information and thus we decline any liability for damages or costs incurred by the use of this troubleshooting.

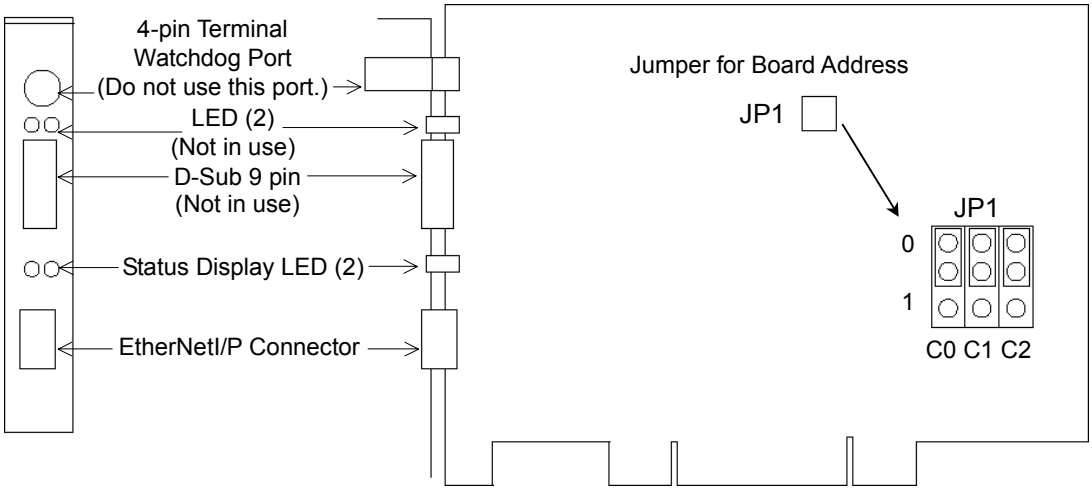
Before examining a problem on the network, please ensure that your established DeviceNet system satisfies network specifications. (Refer to this troubleshooting and the section *2.6 EtherNet/IP Network Construction*.)

4.3.1 Examining a Problem

4.3.1.1 Scanner Board Diagnostic LEDs

The EtherNet/IP board used with EPSON RC+ has two status display LEDs. The layout of the LEDs is shown in the following figure.

PCU-ETHIO



The Module/NetWork LED is on the left and the IO LED is on the right seen from the rear panel. These LED names are used in applicomIO Console application and this manual. Only in this troubleshooting section, general names of the status display of the DeviceNet device are used instead.

The Network Status LED is expressed by the NS LED (NS) in this section.

The Module Status LED is expressed by the MS LED (MS) in this section.

4.3.1.2 Check Network Status

(1) Master Status: MS/NS LEDs

LED	Color		Light Condition		
MS (Module Status)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF
NS (Network Status)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF

(2) Node Number of Absent Slaves

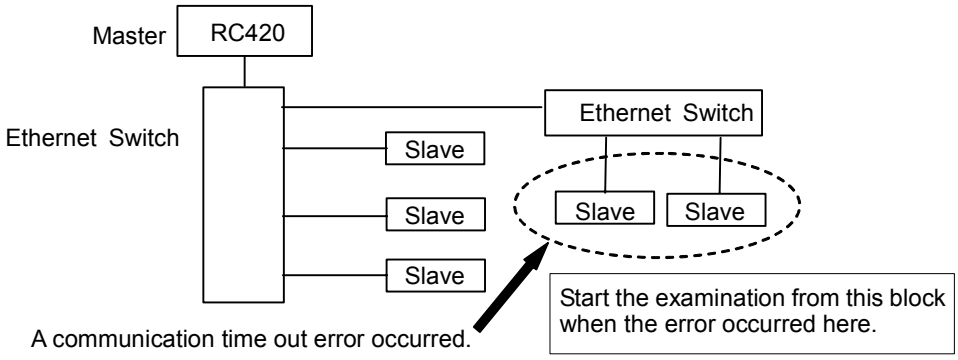
Absent slaves are disconnected from or not added to the network.

1. See the status flag regarding to the removal and addition if the master has status information.
2. See the MS/NE LEDs of all slaves if the master has no status information.

(3) Absent Slave Status: MS/NS LEDs

LED	Color		Light Condition		
MS (Module Status)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF
NS (Network Status)	☐ Green	☐ Red	☐ ON	☐ Blinking	☐ OFF

(4) Physical Node Location of Absent Slave



(5) Error Occurrence Condition

☐ Immediate occurrence (high reproducibility)

☐ Rare occurrence (low reproducibility)

4.3.2 Problems and Countermeasures

Master Unit LED		Error	Description [Reference]
MS	NS		
Green Light ON	Green Light ON	Normal communication	- Normal condition
Green Light ON	Green Light Blinking	During connection establishment	- Processing connection establishment (The NS LED will be ON in green in a few seconds.) - Master function in stop state (Communication does not start.)
Green Light ON	Red Light Blinking	Communication timeout	- Network channel error
Green Light ON	Light OFF	IP address not defined	- The IP address is not defined
Red Light Blinking	No Matter	Critical error	[Refer to the section *4.3.3 Tests and diagnostics.*] - Unrecoverable critical error
Red Light ON	No Matter	Module error	[Refer to the section *4.3.3 Tests and diagnostics.*] - Recoverable error occurred
Light OFF	No Matter	error	[Refer to the section *4.1.2.5 Absent Slave*.] - No slave (Error detection before communication establishment) - Communications power supply OFF
Light OFF	Light OFF	Not initialized status	[Refer to the section *2.9.5 Master Mode* and *2.9.6 Slave Mode*.] - The communication board is not initialized Check the configuration

4.3.3 Tests and diagnostics

4.3.3.1 The diagnostic tool

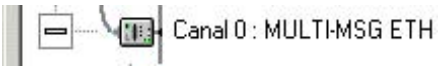
After configuring the EtherNet/IP master, adding and configuring the devices of your network and downloading your configuration in the board, the statuses of all devices can be tested with the diagnostic tool.

tart this tool with the menu command "**Protocol/Diagnostic…**" or with the  button.

See also: To display the help, select [Start]-[Program]-[Direct-Link]-[applicomIO 2.3]-[Help].

4.3.3.1.1 Ethernet/IP channel on Ethernet diagnostics

The EtherNet/IP on Ethernet channel diagnostic information can be displayed by selecting the MULTI-MSG ETH channel.

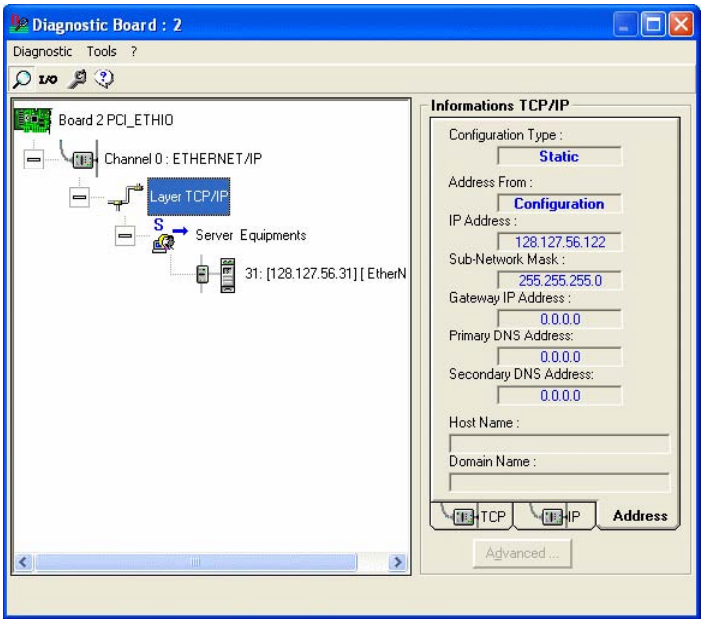


All devices in the configuration are visualized by a LED corresponding to the applicomIO device number.

The LED may be red or green depending on the device error status.

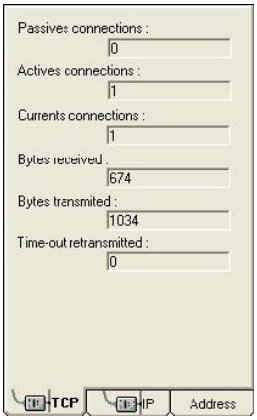
1. Diagnostic of the TCP/IP layer

This screen is used to display the exchange statuses regarding the TCP/IP layer.



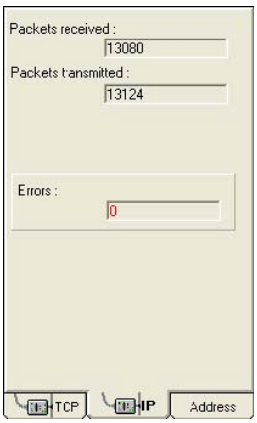
Configuration Type	Mode type selected in the configuration: DHCP, BOOTP, Static
Address From	How the IP address has been obtained, from the server, flash memory or factory address.
IP address	IP address of the applicomIO master on this channel.
Sub-Network Mask	Sub-network address of the applicomIO master on this channel.
Gateway IP Address	Address of the gateway configured on the applicomIO master on this channel.
Primary DNS Address	IP Address of the primary DNS server.
Secondary DNS Address	IP address of the secondary DNS server.
Host Name	Host name of the applicomIO master on this channel.
Domain Name	Domain name of the applicomIO® master on this channel.

TCP tab



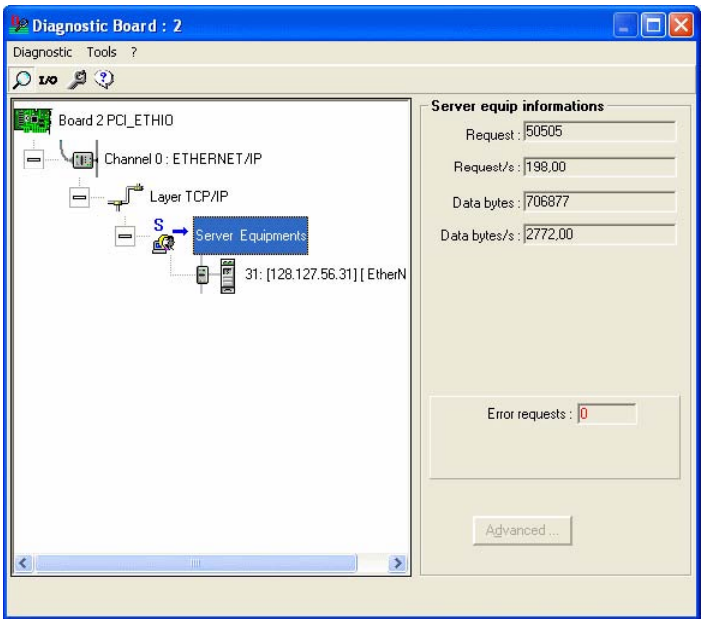
Passive connections	Number of passive connections.
Active connections	Number of active connections.
Current connections	Number of current connections.
Bytes received	Number of bytes received.
Bytes transmitted	Number of bytes transmitted.
Retries on time-out	Number of retries on reception of a time-out.

IP tab



Packets received	Number of packets received.
Packets transmitted	Number of packets transmitted.
Errors	Number of IP errors.

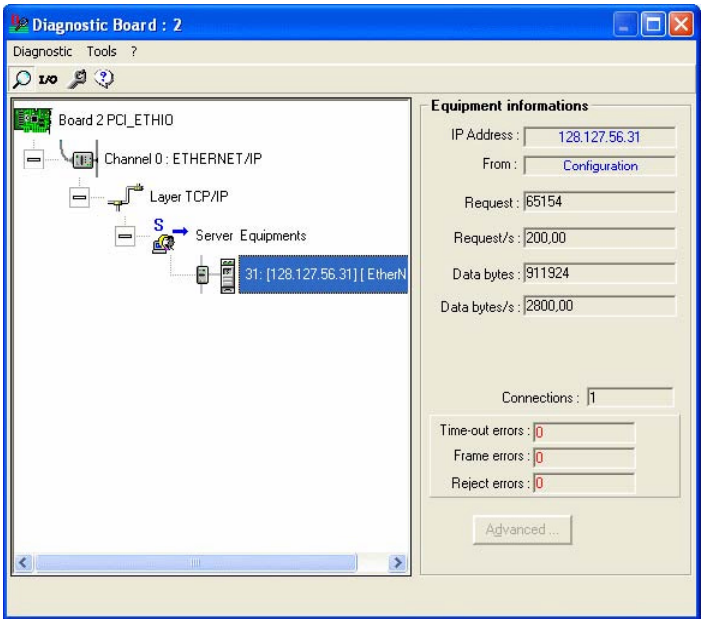
2. Diagnostic of server devices



Requests	Number of requests.
Requests / s	umber of requests per second.
Useful bytes	Number of useful data bytes.
Useful bytes / s	Number of useful data bytes per second.
Requests in error	Number of requests in error.

3. Overall device diagnostics

View the diagnostic information on a device in the configuration by selecting the node which corresponds to the device.



IP Address	IP address of the device.
From	How the IP address of the device was obtained: from the configuration from the DNS server (IP address of the device has been resolved)
Requests	Number of requests.
Requests / s	Number of requests per second.
Useful bytes	Number of useful data bytes.
Useful bytes / s	Number of useful data bytes per second.
Connections	Number of connections created for this device.
Time-out errors	Number of time-outs received for this device.
Frame errors	Number of frame errors for this device.
Refusal errors	Number of errors excluding time-out and frame errors.

4.3.3.1.2 TCP/IP tool

By clicking in the  button and selecting "**TCP/IP layer**", a "**services**" window gives you the following options.

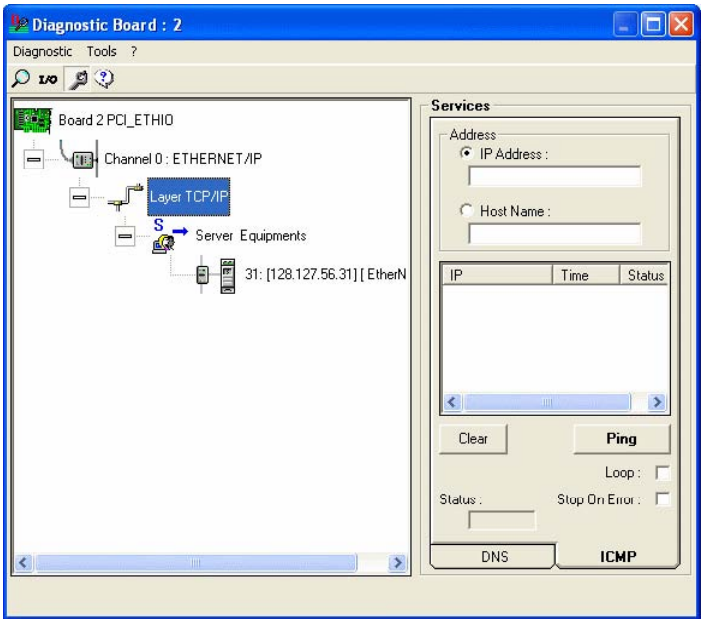
DNS

ICMP (ping)

See also: To display the help, select [Start]-[Program]-[Direct-Link]-[applicomIO 2.3]-[Help].

1. Resolution of IP address or name

DNS functionality is available on the applicomIO solution. It is available through the diagnostic tool, DNS tab.



(1) Selects the type of resolution to be carried out.

IP Address : the host name is obtained from the IP address.

Host Name: the IP address is obtained from the host name.

(2) Carries out a resolution.

(3) Status: Status of resolution carried out

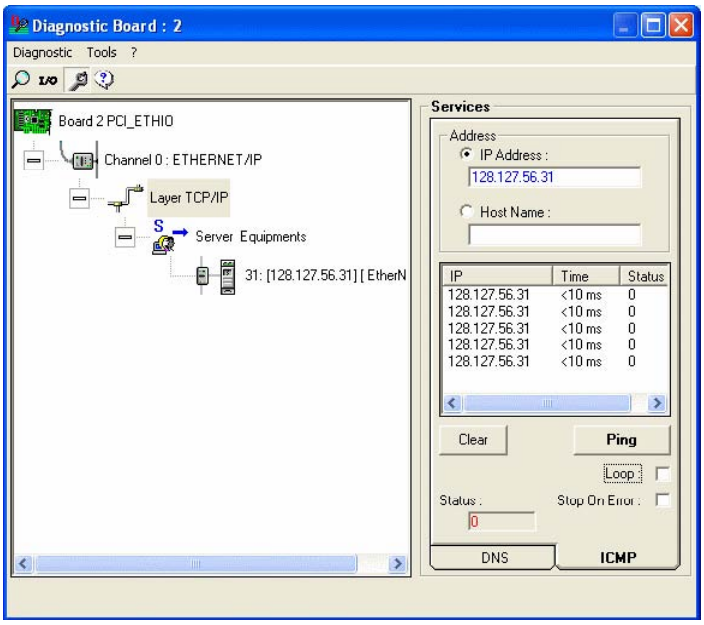
0 : No error

33 : Response time-out exceeded

132 : Negative reply from DNS server (SERVER FAILURE, etc.)

2. Ping

ICMP ECHO "**PING**" functionality is available on the applicomIO solution. It is available through the diagnostic tool, ICMP tab.



(1) Entry field for the IP address or name of the remote station.

(2) Field showing result obtained:

- Status 0 : The station is present and has responded (the response time is given in the Time column)
- Status 33 : The station is not present

(3) Command field:

Clear : Clears the list of results

Ping : Sends a PING command

Loop : Executes PING command in a loop

Stop on Error : If Loop has been selected, stops if an error has occurred

Status : Status of the PING request

0 :OK
33 : TIME-OUT
132: Resolution error

5. Maintenance Parts List

Part Name	Code	Specifications
DeviceNet board	R13B040701	
PROFIBUS DP board	R13B040702	
EtherNet/IP board	R12B040719	

Appendix A applicomIO Upgrade

(1) Start the controller

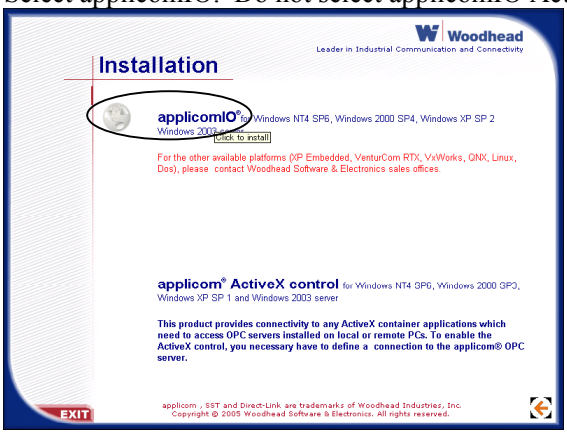
(2) Insert the setup CD that is packaged with the product to the CD-Rom drive on the controller.
Setup program starts automatically.

(3) Select the desired language for the installer.

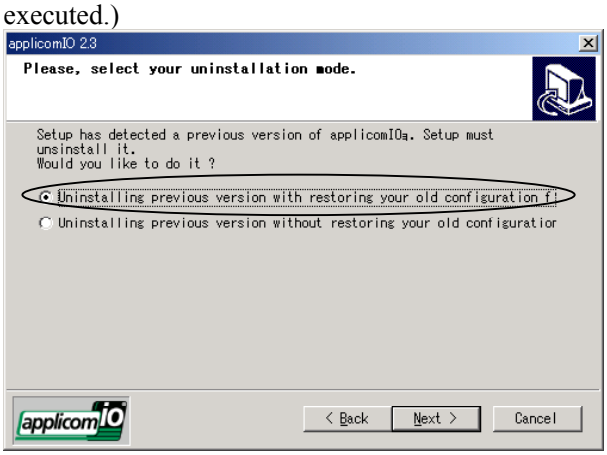
(4) Select Products Installation.

(5) Select Installation.

(6) Select applicomIO. Do not select applicomIO ActiveX.

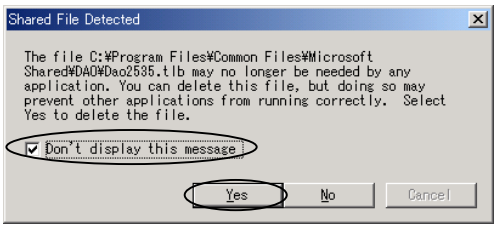


(7) Following dialog appears. Select the option above.
(If the option below is selected, the transition of the current setting will not be executed.)

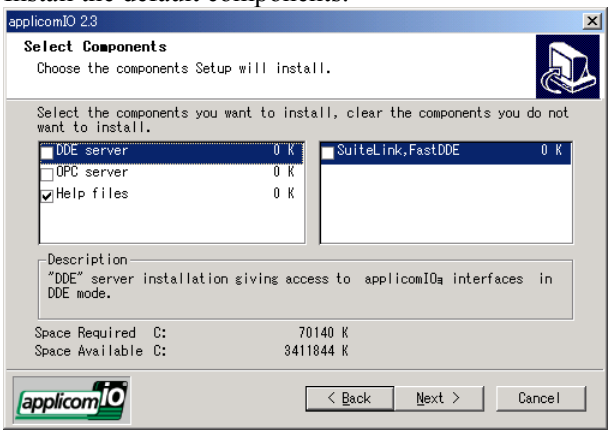


(8) Uninstall the current applicomIO before upgrading.
Following dialog appears. Click the **OK** button.

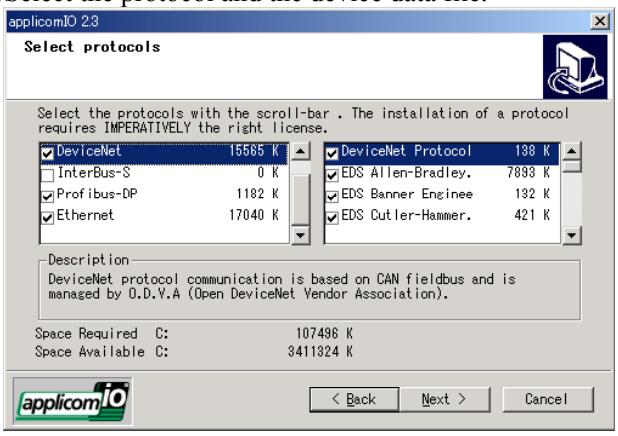
Following dialog appears. Check the [Don't display this message] box and click the **Yes** button.



(9) Install the default components.



(10)Select the protocol and the device data file.



(11)Complete the installation.

(12)The message to ensure the restart appears. Click the **Yes** button.

(13)When a service pack is attached to the CD-ROM, install the service pack.

(14)After completing the installation of the service pack, shutdown the computer.